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DEFENSE INDUSTRY BULLETIN

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The *Defense Industry Bulletin* is published monthly by the Business & Labor Division, Directorate for Community Relations, Office of the Assistant Secretary of Defense (Public Affairs). Use of funds for printing this publication was approved by the Director of the Bureau of the Budget.

The purpose of the *Bulletin* is to serve as a means of communication between the Department of Defense (DOD) and its authorized agencies and defense contractors and other business interests. It will serve as a guide to industry concerning official policies, programs and projects, and will seek to stimulate thought by members of the defense-industry team in solving the problems that may arise in fulfilling the requirements of the DOD.

Material in the *Bulletin* is selected to supply pertinent unclassified data of interest to the business community. Suggestions from industry representatives for topics to be covered in future issues should be forwarded to the Business & Labor Division.

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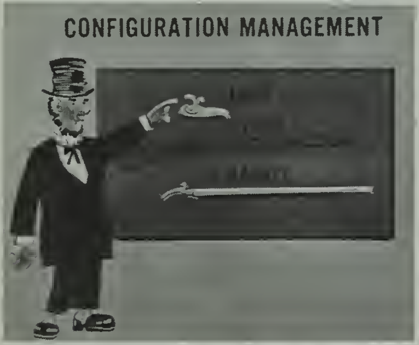
Objectives of Configuration Management

Lieutenant General William B. Bunker, USA

Our overall objective in the Army is to make sure that the combat soldier has the best possible weapons and equipment and that he has it at the right place, right now, in the needed quantities. Configuration management can help the Army achieve this objective.

Early discussion on configuration management inspired fears that a whole new discipline—bringing with it a whole new breed of people—was being created. Nothing could be further from fact. The new emphasis on the subject simply reflects an attempt to restore an ancient principle, tailored to a new set of conditions.



We had it, then lost it. Eli Whitney introduced configuration management at the beginning of the last century. His techniques gave the North an edge on the South during the Civil War that some historians credit with ultimate victory. It was a new thing then to introduce weapons with completely interchangeable parts. In many areas, it would be a new thing today, and it could give us a tremendous edge in any new combat.

Back in the days when life and weaponry were simpler, the Military Departments had no trouble defining the hardware they wanted, and producers had no trouble living with the simple specifications that established requirements. In the beginning, the producer was often just another agency of the requiring Department; no contracts were involved, communications were uncomplicated, and costs were nearly constant, whether plans changed or not.

In those days, there weren't many ways to solve a given problem. There were only a few acceptable designs for a saddle, or a cannon ball, or a musket. It didn't take so many tons of paper to define a piece of hardware. But things have changed.

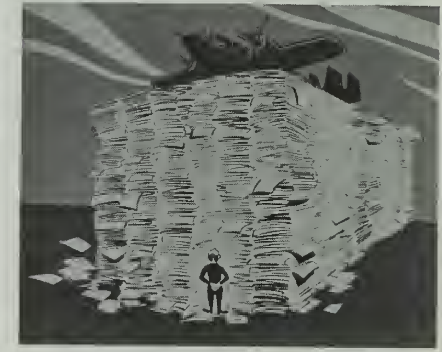
Someone has estimated that the documentation for a new aircraft weighs more than the aircraft, and another statistician has computed the number of cars in a freight train needed to haul design and production data for a new missile system. Obviously, nothing that complex can be managed—unless we can simplify the system.

Configuration management is an attempt to simplify the system. It seeks to reduce the elements involved to their simplest terms, equip each problem with a convenient handle, and display the whole situation in such a fashion that management can comprehend it, analyze it, and control it.

Actually, it doesn't do anything Eli Whitney didn't do a century and a half ago. It defines the product, its components, and their interfaces. It restricts idle change, and it requires precise records of the changes that are authorized. But it does it in a modern manner.

Objectives of the Techniques

The goal, of course, is to solve the problems that could be identified.



- The **object of each** new project must be established early in the program. Once established, the objectives must be freed from vacillation.
- All practical **approaches** to achievement of the established objectives must be studied, and the best one selected. Once selected, maximum effort must be directed along the chosen course.
- **Change activity must be** reduced to the realistic minimum, and the reduced activity must be handled expeditiously.

- Maximum uniformity must be effected where the Military Departments interface with industry and with each other.
- Control must be exercised during production to assure maintenance with uniform spare parts, tools, test equipment and instructions, and reproduction in a competitive market.
- Authority and responsibility for configuration management of each item must be assigned to a designated individual.

Fringe Benefits Expected

With the achievement of these objectives should come a long list of fringe benefits. Among them are:

- Assured hardware performance and improved logistic support and weapons readiness.
- Enhanced standardization and item-entry control.
- Increased competitive procurement.
- Reduction of requirements for technical data of doubtful value.
- Increased uniformity of contract administration.

- More effectiveness and timeliness in management decisions at all levels.
- Intermeshed implementation of such other DOD programs as contract definition, the Resource Management Systems, PERT, value engineering, and technical data management and standardization.

Three Phases of Configuration Management

The success of the configuration management technique depends on the balanced integration of three interrelated, mutually supporting phases.

- Configuration identification.
- Configuration control.
- Configuration status reporting.

Configuration identification is the documented descriptions of systems and equipment.

In order to serve the combat soldier, we must get a clear expression of his needs. He expresses his needs through the Combat Developments Command in the form of a Qualitative Materiel Development Objective (QMDO) or a Qualitative Materiel Requirement (QMR). In the Army Materiel Command (AMC) we ratify these documents and identify the risk involved in satisfying the requirement and, when the document is approved by the Department of the Army, it is considered a contract between AMC and the user.

When the user is not quite sure what he needs, he states his objective in a QMDO and we, together with industry's strong right arm, help him refine his objective during contract definition into a system description, *i.e.*, QMR, technical characteristics and test and evaluation requirements, along with a description of work and services for the development. Thus we have created a clear identity of the equipment the user wants.

When completed it is duly released and recorded in the status recording system or data bank. This identity is the product of many different types of people, all with differing and sometimes diverging interests. Some of these people, in addition to the project engineer, are the standards engineer, maintenance engineer, production engineer, human factors engineer, training specialist, support equipment specialist, publications specialist, and test engineer.

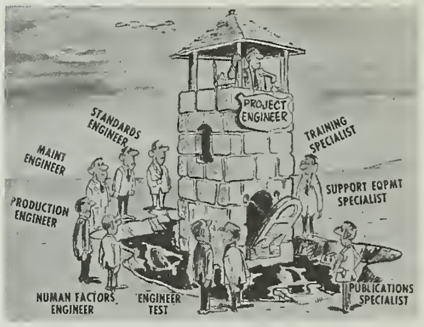
Each of these people has a part to play in fielding a satisfactory and complete weapon system. But, alas, some of these birds are not of the same feather and don't always talk on the same frequency. In fact, they don't even speak the same language. Project managers and commodity managers have done much to break down these walls, and the formal review of Engineering Change Proposals should improve communications.

Awarding the Development Contract

Theoretically, then, when we award a development contract to industry, it reflects not just the specific functions of the weapon itself; it should, hopefully, reflect the environment in which it will operate, the support requirements, its relationship to other weapon systems, training implications, maintenance, publications and operability.

It also has gone through the requirements of concept formulation to assure that we have done our homework before going to industry.

Industry now has our work statement in terms of performance requirements. Its engineers, as they progress on their design work, inevitably come up with proposed changes to improve performance, schedule, or cost, in response to incentive provisions in our contracts, among other considerations.



The performance descriptions in many instances do permit, and even encourage, changes as a result of trade-off studies within the scope of the contract. This is done to permit the contractor maximum latitude and creativity in developing the best bang for a buck.

The In-Process Review

However, these proposed changes must be reviewed when they affect the performance requirements because we have a written contract with the user. In-process reviews during the development process, with representatives of the various functional activities, provide a means of design control to assure that we progressively keep our customer's needs in mind and inform him of our progress.

The Configuration Audit Review

To assure that the weapon, which has satisfied our user test requirement, can be built again, we require two additional reviews of our drawings and specifications, one of which may be conducted concurrently with the prototype systems review. This is the configuration audit review.

The configuration audit review verifies that the drawings and descriptions accurately describe the service test models and, when updated, reflect the correction of service test defects. This represents the Technical Data Package used in the first article configuration review. This latter review is a technical audit to verify that the production item conforms to the Technical Data Package and will satisfy the user.

Engineering Change Policy Aids Configuration Control

The introduction of configuration management has had a significant effect on our attitude concerning engineering changes. Proposed engineering changes now receive a greater degree of scrutiny than ever before. Technical feasibility alone does not constitute the sole justification for the approval and incorporation of engineering changes to hardware or software.

Proposed changes must survive the super-critical probing of the change control staff and project manager or approving authority to achieve acceptance. This analysis consists of an unrelenting application of trade-off considerations that must prove the worth of the change. The proposed change must be necessary to correct design deficiencies to provide for approved changes in operational characteristics; to effect overall net savings; to relieve production stoppages; or otherwise to offer a significant net benefit to the Government.

Configuration Status Reporting

Configuration status reporting involves our engineering records system. This element involves the recording of the QMR, the Development Purchase Description, and the Technical Data Package used for quantity production and any changes to each, including modification work orders by serial number, to provide the manager with current visibility of his program and equipment at all times, even in the operational period.

Industry Help Needed

AMC has directed that configuration management be implemented on all major projects. Implementing this discipline effectively requires close industry support on a continuing basis. Industrial executives will be much concerned with the specific requirements of configuration management, particularly with the preparation of descriptions and drawings and engineering change proposals. They may expect more scrutiny of Class II changes by the Government.

On the other hand industry, as well as the Defense Contract Administration Services Regional Offices, should profit considerably as a result of the greater uniformity of forms, formats, etc., used by the various commands within AMC.

Configuration Management No Panacea

All Military Departments have experienced the effects of uncontrolled changes. Aircraft specifications have veered from single engine to multi-engine, from attack to fighter, and from single place to two place. Missiles have switched from field artillery to air defense and back again, from liquid to solid propellant, and from short, to medium, to long range. Similar changes have been made in ship and land vehicle requirements. These have resulted in increased costs, stretched-out schedules, and even the death of projects.

We have delivered spares that didn't fit, tools that wouldn't work, and instructions that didn't match the hardware. And there's nothing in the new configuration management techniques that, by itself, will prevent it from happening again. If we are to be more successful now, it will be because of the additional discipline, uniformity and systemization introduced with the new regulation—and the conscientious intelligence with which it is implemented.

Configuration management provides a tool for correction of many of AMC's hardware problems. But it's not a fully automatic tool—it can't be installed, programmed, switched on, and left to run itself. Like most tools, it will perform well only when used with skill, conscience, discretion and energy.

Lieutenant General William B. Bunker, USA, is Deputy Commanding General, U.S. Army Materiel Command. He has been assigned to AMC since it was established in June 1962 and served previously as its Comptroller and Director of Programs. General Bunker is a graduate of the U.S. Military Academy and holds a degree of Master of Science in Engineering from the Massachusetts Institute of Technology.

Project ARISTOTLE

Eugene T. Ferraro

Project ARISTOTLE (Annual Review of Information and Symposium on the Technology of Training and Learning and Education) was announced in the March 1967 issue of the *Bulletin.* In my capacity as DOD executive agent for ARISTOTLE, I attempted to describe in that article the purpose and scope of this joint effort among representatives from the emerging education technology industry, the Defense Department, Office of Education, and other interested Federal agencies. In response to that article and other announcements, a great number of inquiries have been made about the progress of ARISTOTLE. In this article I would like to highlight some of the significant activities, progress and expectations of ARISTOTLE.

The ARISTOTLE Steering Committee, chaired by Marvin Kahn, Vice President, Aircraft Armaments, Inc., is comprised of 10 task groups. The task groups and their chairman are listed below:

Project 100,000
Chairman: Dr. Gilbert E. Teal,
Dunlap & Associates, Inc.

Media
Chairman: F. A. Centanni,
Sylvania Electric Products, Inc.

Information Storage, Retrieval and Dissemination
Chairman: Dr. Paul Weaver,
Xerox Corp.

Educational Research
Chairman: Dr. James E. Gilbert,
Northeastern University

New Developments
Chairman: Dr. Harvey J. Brudner,
Westinghouse Learning Corp.

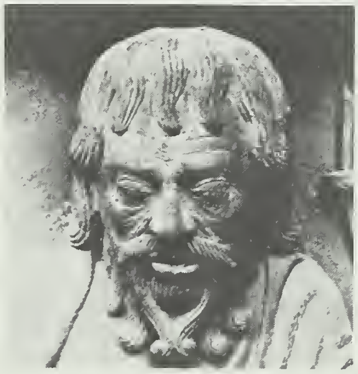
Systems Approach to Education
Chairman: Henry Lehmann,
General Electric Co.

Standards, Measurement and Evaluation
Chairman: Dr. D. W. Meals,
Raytheon Co.

Courses, Tasks and Skills
Chairman: Walter Stellwagen,
Science Research Associates

Government-Industry-Education Interface
Chairman: T. W. St. Clair,
North American Aviation, Inc.

International Considerations
Chairman: T. Jack Heckelman,
Philco Corp.



The primary function of the Steering Committee is to provide policy guidance and to coordinate the activities among the 10 task groups. At the same time they have been maintaining contact with relevant government officials to ensure that the problem areas, which ARISTOTLE groups are looking into, correspond with priority areas of concern to Federal agencies, local governments, and potential users of innovations in education.

The problem and priority areas presently being studied will be topics of discussion to be conducted by 10 panels, consisting of ARISTOTLE members, at a symposium to be held on Dec. 6 and 7 in Washington, D.C. In addition to the panel meetings, plans are being made to have noncommercial demonstrations of advanced application of new education technologies at the December symposium.

Media

The task group studying media, headed by Mr. Centanni, has been reviewing effectiveness' studies of existing media which have been used in training and education programs, both within and outside the military.

The East Coast Group is reviewing selected current and past programs where new uses of media have been made, including:

- Oakland Community College, Bloomfield Hills, Mich., which is attempting to automate and individualize instruction for its students.
- The Oak Park and River High School Project, Oak Park, Ill., which is using a random access audio retrieval system.
- The New York City "Shut-In" Program utilizing audio-visuals, the telephone and educational television.

The West Coast Group is surveying the usage of media in the Minuteman and Polaris programs, as well as evaluation of existing media used at the San Diego, Calif., Naval Training Center.

We are hoping that these studies will provide some new insight explaining perhaps why certain media have been more successful than others for particular types of instruction.

Information, Storage and Retrieval

The overall objective of this task group is to survey the state of the art in various aspects of information, storage and retrieval (IS&R). Fifteen subgroups have finished their reviews of storage systems, dissemination and communications, copyrights, libraries, software and definitions. Prior to the December symposium, the Education Communications (EDUCOM) Information Network, Education Research Information Centers (ERIC), the regional educational laboratories, file systems, and time-sharing will have been covered. These reviews will be published prior to the conference in order to facilitate criticism and discussions. This group's efforts and its recommendations should pay off handsomely in assisting an equitable and efficient dissemination of research results, training material, and other information directly related to the improvement of education.

New Developments

Dr. Brudner and his associates have been concerned with identifying, encouraging and communicating "new developments" in equipment, processes and approaches in the field of educational technology. New developments with respect to effectiveness, validity and operational practicality are being evaluated. The group is investigating new teaching machines, audio-visual systems, computer software, related areas of automated testing procedure, communication contributions, and computer assistance systems.

Four meetings, attended by an average of 35 industrial, military, university and other representatives, have been held to discuss new developments, and the following future projections appear to have achieved a general consensus:

Computer-Assisted Instruction (CAI).

- Most systems presently in use are experimental. At present the Defense Department is supporting at least 10 major projects in the state of development.
- A complete CAI system development may take as long as six to eight years to evolve to an operational status, with the average time to develop a full course for a CAI system taking two years.
- Some of the best software materials are being generated by team efforts, requiring as long as six months before they are well integrated and productive. A major problem here is to find the best organizational technique to facilitate effective cooperation between hardware, software and curriculum experts.
- System capabilities are now limited to about 30 terminals costing several thousand dollars each. Several projects, being funded by DOD, indicate that multi-access, online, time-shared systems will greatly expand the potential of CAI. Also, important breakthroughs are occurring in the area of devices for student input, such as the Plasma Tube Display Panel developed by the University of Illinois on the PLATO program.
- Some long-range research is now leading to application of artificial intelligence techniques in CAI systems. In these approaches the computer would be able to generate sentences automatically via syntactical and transformational rules and language processing capabilities.
- New developments in software generation are cutting the present ratio of 125-manhours effort to generate one hour of CAI software.

Audio-Visual Developments.

- New motion picture film formats, such as super 8mm, which allow for more efficient use of film area and higher sound fidelity, have been developed and are awaiting demonstration of feasibility.
- New research techniques for multiplexing of visual information on film, including laser holography and parallax-panoramagrams, are being generated and offer great potential.
- New three-dimensional display techniques, using the above approaches, plus new cartridge-loading projectors, both for silent and sound systems, are being developed in industrial laboratories.

Communications.

- Increasing use of common-carrier, digital-transmission schemes for data, audio and visual information can be expected.
- High-capacity information flow systems, including lasers, new waveguide approaches, and bandwidth compression techniques, employing telephone wires, will have a significant impact on learning.
- Use of satellite systems, plus new integrated, wide bandwidth receiving antennas, will provide new opportunities in education by several orders of magnitude.

Teaching Machines and Recorders.

Major trends in the near future include:

- Increasing use of magnetic belt, compact recording systems in education and training.
- Development of higher quality and lower-cost color video recording systems.
- Integration of slide projectors and magnetic tape audio systems.
- Economical, random-access magnetic recording and playback units.
- New techniques for computer-generated software for teaching machine systems, including computer-animated films.
- New semi-computerized teaching machine systems.

While the discussions of the New Developments Task Group have been directed largely toward new technological developments, it has increasingly become apparent that management capabilities and procedures generally have not been developed to use effectively the technology which is available. Obsolete or non-performance based on procurement specifications, fragmentation of decision making, inadequate project management, program evaluation, and other non-technical obstacles prove to be as significant in thwarting innovation as the failure to support technological development *per se*.

In terms of improving communications there has been a genuine "give and take" during the four sessions between military trainers, research and development officers, and industrial technical experts. The rapport is certainly to be encouraged and is necessary as the Defense Department continues to improve the quality of instruction for its personnel.

Systems Approach

Unfortunately, the advent of the systems approach in education has been attended by a lack of clarity in the area where communication is so vital. Mr. Lehmann's task group is attempting to describe the systems approach as applied to education and training in clear and simple terms, hoping that a prescriptive methodology can be compiled into a small booklet which will be the basis for the panel discussion at the symposium. At the December symposium three cases histories, in which the systems approach has been used (including Oakland Community College), will be presented and analyzed against the check-list in the booklet to encourage constructive criticism, and to point out the problems in attempting to systematically analyze education endeavors.

Standards and Measurements

The purpose of this task group's effort is to minimize the communications gap between industry, DOD and the education community regarding standards of measuring the effectiveness of the new technology. Members of this group are now reviewing certain procurement specifications to determine the impact they have on the type of media which are allowable. Pedagogical measures, such as the 90/90 criteria (90 percent of the students make 90 percent or above on tests) in programmed learning, are being studied to determine whether such criteria are adequate.

Courses, Tasks and Skills

Working closely with other task groups this particular task group, under Dr. Stellwagen's leadership, will focus its attention largely on how industry can assist DOD in Project TRANSITION. President Johnson in his 1967 Manpower Report to the Congress stated: "We must make military service a path to productive careers. To help them (Service separatees), I have asked the Secretary of Defense to make available, to the maximum extent possible, in-Service training and educational opportunities which will increase their chances for employment in civilian life."

The Secretary of Defense has established Project TRANSITION to carry out the President's desire. The target group for the initial phases of the project will be those individuals who have from one to six months' service time remaining, and who have expressed their intention not to reenlist. The project will ascertain the kinds of in-Service training this group desires and their educational needs. It will then furnish training or educational courses which are keyed to favorable employment opportunities.

Pilot programs have been initiated at Fort Knox, Randolph AFB, Treasure Island, and Camp Lejeune. Industrial assistance will certainly be helpful in relating the skill requirements and job demands which they are planning. Moreover, with the existing pressures on existing Service facilities, there would appear to be an opportunity to utilize some of the new education technology and self-instruction principles in off-duty hours instructions, as well as to supplement existing formal and on-the-job training now being conducted by the military.

Government-Industry-Education Interface

As industry tries to enter the education market, ideological issues raised are second only to parochial interests which need to be quelled. The fundamental problem appears to be whether or not a mechanism can be developed which can guide the prodigious resources of industry in such a way that the public interest in education can be best served.

The first step here is to ensure effective communications between the supplier and the users. To accomplish this, Mr. St. Clair and his task group have prepared a questionnaire to be sent to over 600 companies. The results of the questionnaire, to be discused at the December symposium, should provide among other things:

- An inventory of company interests which will provide a data base for DOD and other Federal offices.
- An indication of industry research and development emphasis in the education area.
- An inventory of in-house training and education programs which industry is now conducting.

Dr. Eugene T. Ferraro has been serving as Deputy Under Secretary of the Air Force for Manpower since June 6, 1966. Dr. Ferraro, a native of Patterson, N.J., is a graduate of Rutgers University. He received his doctorate from the New School for Social Research, New York, N.Y. From 1953 to 1966, Dr. Ferraro served with the Aerospace Group, General Precision, Inc.

Summary

Several comments about the general status of ARISTOTLE and its activities are appropriate here.

First of all, the major objective of ARISTOTLE is to improve communications among industry, the Government and the education community. The joint discussions held thus far have been very beneficial and we anticipate that the December symposium will further improve effective communications.

Second, although this is a follow-up action to the government-sponsored June 1966 conference, the industry-manned Steering Committee, working closely with the staff assistance of the National Industrial Security Association (NSIA), is accepting responsibility and leadership. Federal officials, including members of the Military Services, are serving as subject matter advisors and briefers only upon request of the task group chairman.

Third, most of the on-going activities of ARISTOTLE are focused on the December symposium. We do, however, expect ARTISTOTLE to be a continuing annual review of activities in this new area of emerging education technology. NSIA assisted us in handling the administrative tasks of the June 1966 conference; this year it is also handling the December symposium.

Lastly, the participation of ARISTOTLE is broadly based. More than 20 percent of its members are non-NSIA members; over five percent have university affiliations, and over 10 percent come from not-for-profit organizations. Quite intentionally, we have encouraged the broad base to get the cross-fertilization that is

(Continued on inside back cover)

Managing the Naval Material Command

Vice Admiral Ralph L. Shifley, USN

The Naval Material Command (NMC) is charged with effectively, efficiently and economically converting Navy assets and resources—talent, time and money—into the goods and services required by the operating forces of the Navy and the Marine Corps. In fulfilling their responsibilities, Navy managers, like their counterparts of business and industry, face one underlying problem: the problem of determing how best to employ their resources in the pursuit of their goals.

In NMC three fundamental rules govern the Navy's basic approach to efficient management of the large-scale technical programs which produce the wherewithal of seapower. These rules are:

- The responsibilities of each element of the NMC are clearly defined.
- "Systems Projects" are employed to control and coordinate the efforts of the NMC within broad, related technical areas.
- Project management is employed where the benefits of this intensive management technique warrant extraordinary management measures.

The main functional efforts of the NMC are carried out by six operating organizations—the systems commands. Each systems command has one specific, related set of responsibilities.

- The Naval Air Systems Command, for example, is responsible for the total Naval air weapon.
- The Naval Ship Systems Command builds, overhauls and repairs ships and certain of their principal components.
- The Naval Electronic Systems Command performs material support functions for shore electronics, and for certain other electronic systems. It is the Navy-wide technical authority for electronics standards and compatability.
- The titles of the Naval Ordnance, Supply, and Facilities Engineering Commands suggest the basic functions of those organizations.

A review of the duties of the systems commands shows that full authority and responsibility, in specified technical areas, are assigned to certain systems commanders. This has been done very carefully and in considerable detail, as a basic management concept within NMC.

The management problem here is to carefully identify the interfaces between the systems commands. This has been done, and the "territory" of each systems command is spelled out in its charter. Sharp interfaces and precise definition of responsibility have been made matters of record.

Vice Admiral Ralph L. Shifley, USN, became Deputy Chief of Naval Operations (Logistics) on Aug. 1, 1967. At the time this article was written, he was Vice Chief of Naval Material. Before his assignment to the Naval Material Command in 1963, Admiral Shifley served as Commander, Carrier Division Seven. He is a 1933 graduate of the U. S. Naval Academy.

In some cases the exact borderline between responsibilities of systems commands is difficult to draw in advance. In these cases, one commander is given, in his charter, controlling authority over a given subject.

For example, several systems commands may have responsibility to provide equipment for a new ship. Someone must make certain that every item of equipment is compatible with every other item. To handle this type of problem, the charter of the Ship Systems Command assigns responsibility for "total system integration" to the commander of that systems command. Similarly, the Electronic Systems Command is responsible for overall Navy electronics standards and compatibility.

This emphasis on precise definition of interfaces, on careful and formal delineation of responsibilities, on elimination of hazy areas, is one of the underlying principles of management within NMC.

A second principle is applied when the weapons required in certain broad fields of warfare must be pulled together from throughout NMC, and managed as entities. In these cases, NMC utilizes the unique capabilities of systems project managers.

The manager of the Anti-Submarine Warfare (ASW) Systems Project, for example, crosses the boundaries of all the systems commands to assure unity of material support throughout this broad area of warfare. The manager of the ASW Systems Project controls the characteristics of some 160 major items of ASW hardware.

The Navy has three such systems projects: the Surface Missiles Systems Project, the Fleet Ballistic Missiles Systems Project, and the Anti-Submarine Warfare Systems Project.

A systems project manager gives overall guidance and direction in a total warfare area. He monitors, coordinates and integrates tasks related to material items under his cognizance, wherever these tasks may be performed.

You have seen that one primary management technique used within NMC is to precisely define interfaces between systems commands and describe these boundaries in the characters of the commands. The second basic technique is to establish systems project managers whenever a great many systems, relating to a single broad area of warfare, must be managed in a carefully coordinated fashion.

The third fundamental management procedure within NMC is to utilize project management where this special technique is warranted.

Project management may be called for under various combinations of situations. For example, project management may be appropriate where there is a clearly definable job to be done, with a beginning and an end, which:

- Is of urgent military necessity.
- Has top level interest.
- Is particularly expensive.

Work efforts involving more than $25 million for research and development, or $100 million for production, are projected, with very few exceptions.

Other criteria may include:

- Exceptional complexity.
- Multiple agency or Service interest.
- Advanced technology.
- High risk of slippage in schedule or cost.

The Polaris project, for example, had and still has most of these characteristics. It was definable, costly, complex, urgent and vital.

When a project is established, a project manager, supported by a highly qualified staff, is formally charged with providing:

- Singleness of purpose.
- Coordination and control of resources (talent, money and time).
- Machinery for making decisions rapidly.
- Appropriate executive authority for the expeditious achievement of his goals.

The Navy has 12 designated projects today at the level of the Chief of Naval Material. They are:

PM1 Fleet Ballistic Missile Systems Project.

PM2 F-111B/Phoenix Weapon System Project.

PM3 Surface Missile Systems Project.

PM4 Anti-Submarine Warfare Systems Project.

PM5 Instrumentation Ships Project.

PM6 ACLS Project.

PM7 REWSON Project.

PM8 Project AIMS.

PM9 Project OMEGA.

PM10 Fast Deployment Logistics Ship Project.

PM11 Deep Submergence Systems Project.

PM12 Naval Inshore Warfare Project.

On completion of the specific task for which the project is organized, the project will be disbanded and its resources reassigned to the functional commands.

The organization of the NMC as a whole is shown in Figure 1.

As you see from the dashed line, the project managers and systems project managers have authority to draw on the resources of all the functional commands.

Within the field activities is a complex of 29 laboratories which supports the systems commands and the project managers.

These are all commanded by the Chief of Naval Material and are available to perform work assigned to them by a variety of customers. Due to their special capabilities, certain of these laboratories work almost exclusively for a single systems command. Fifteen of the 29 have this characteristic. The others put their efforts into tasks requested by several systems commands, by the other Services, or by the National Aeronautics and Space Administration, the Federal Aviation Agency, or other agencies.

This is an outline of the basic principles of management and a thumbnail sketch of the organization utilized by the Chief of Naval Material. Under his stewardship, about $11 billion dollars are spent each year in acquiring material and weapons, and in providing the material support required for the operating forces in the Navy and Marine Corps.

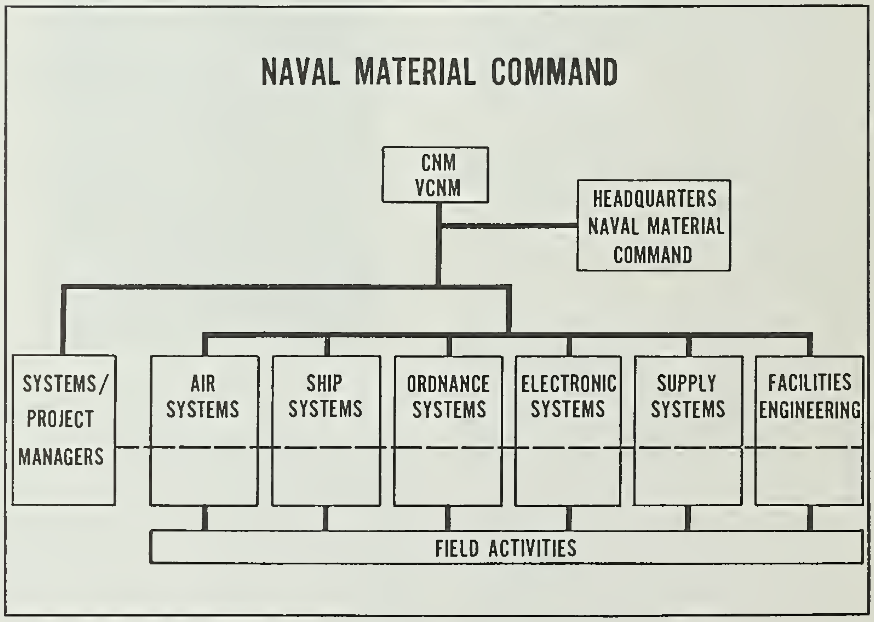


Figure 1.

Handicapped Workers Complete Important Defense Contract

Handicapped employees of the Opportunity Workshop of Lexington (OWL), Ky., have completed their second defense contract making an important contribution to the Vietnam effort by supplying 4,084 wooden supports for ammunition storage containers to the Naval Ordnance Depot, Crane, Ind.

Nearly all of the more than 450 physically and mentally handicapped trainees at OWL joined forces in completing the $26,402 contract, which provides the Navy a vital product used in shipping ammunition to Southeast Asia.

OWL, a non-profit, self-supporting corporation, was founded in 1961 by the Junior League of Lexington, and provides training for handicapped persons from the central Kentucky area, many of whom are former Veterans Administration hospital patients.

The center provides training in woodworking, upholstery, furniture refinishing, spray painting, small-truck driving, office work, and competes in the open market for contracts and jobs it is equipped to handle.

For the defense contract, awarded by the Defense Construction Supply Center, Columbus, Ohio, the OWL trainees cut and assembled pallet tops, side supports, and side panels which are used to enclose ammunition.

Workers at OWL must be vocationally handicapped, physically or mentally. They must be 16 years old or older, with a reasonable hope that after training they will be capable of obtaining regular jobs.

Ron Hampton, director of the Lexington workshop, stated during a program held at OWL in June, to give trainees a better understanding of the role they are playing in the Vietnam war effort, that the fact the contract was awarded to OWL shows the country's faith in the handicapped worker.

OWL was low bidder for the Navy contract over companies competing from a six-state area.

DOING THEIR PART IN THE VIETNAM EFFORT—Handicapped trainees of the Opportunity Workshop in Lexington, Ky., drill holes prior to the assembly of supports for ammunition containers. Looking on are Navy and Marine Corps personnel who visited the workshop in June to commend the workers for their efforts.

Industrial College Seminar Schedule Announced

The Industrial College of the Armed Forces, Washington, D.C., will conduct National Security Seminars during the 1967–1968 academic year in the following cities:

Casper, Wyo., Oct. 16–27; Wilmington, N.C., Nov. 6–17; San Antonio, Tex., Jan. 8–19; Lake Charles, La., Feb. 5–16; Merced, Calif., March 4–15; Minneapolis, Minn., April 1–12; and Gary, Ind., May 13–24.

The two-week seminars are based on the 10-month resident course on National Security conducted by the Industrial College. Each seminar consists of 32 lectures supplemented by visual aids. Two forums are also included.

Seminars will be conducted by a team of Army, Navy, Air Force and Marine Corps officers from the faculty of the Industrial College.

Administrative support is provided by a primary military sponsor, including a seminar administrator, who is a senior reserve officer called to active duty for 90 days. A civilian agency, usually the Chamber of Commerce, serves as co-sponsor, with a prominent citizen appointed locally as general chairman.

Attendance is open to representatives of industry, labor and the Government, as well as regular and reserve military officers who may request orders to attend through regular military channels. Civilians can obtain information on enrollment procedures from the Chamber of Commerce of the city where the seminar is to be held.

Airborne Passive Scanning Infrared Imaging Systems

C. Donald Garrett

The purpose of DOD Instruction 5210.51, "Security Classification Concerning Airborne Passive Scanning Infrared Imaging Systems," which became effective on Nov. 1, 1966, is to prescribe the following:

- Uniform standards and criteria for classifying information pertaining to certain airborne passive infrared imaging systems.
- Levels of capability of such imaging systems at and below which operating data can be disclosed without jeopardizing national defense.
- General guidance governing the issuance of specific classification guides for individual imaging systems.

This article will discuss the major features of the instruction and explain to some degree the philosophy or principle involved. To set the stage, it will be helpful to review some of the background events which led to its issuance.

Some six or seven years ago engineers and technicians concerned with remote sensing of the environment expressed themselves about the lack of knowledge and availability of various kinds of remote sensors. At that time it was felt that these deficiencies were traceable, in large measure, to the fact that many of these sensors had been developed by the military and the security classifications, which had been applied, made it difficult for non-military users to obtain the equipment or knowledge as to what this equipment could do. Consequently, they set out to see what could be done.

In 1961 the National Academy of Sciences-National Research Council became concerned officially. The upshot was a contract by the Office of Naval Research, jointly financed by contributions from the other Services, to the Institute of Science and Technology, University of Michigan, to conduct a study to determine what could or should be done concerning the security classifications assigned to information relating to various remote sensing equipment.

During the study the Institute conducted two symposia and a classified meeting. There were several interim reports, notably one issued in December 1962 titled "Statement of Need for Reviewing Security Classifications Governing Airborne Electromagnetic Sensory Devices and Data." The final report was issued in October 1963.

C. Donald Garrett is Deputy Director for Classification Management in the Directorate for Security Policy, Office of the Assistant Secretary of Defense (Administration). He has served in the Directorate for Security Policy since 1958 and previously was Executive Secretary of the Security Screening Board and Security Review Board, Office of the Secretary of the Army. He holds a bachelors degree from Franklin and Marshall College and an L.L.B. degree from George Washington University.

Without attempting to brief all the substance of the Institute reports, it was found that remote sensing equipment using infrared and radar, and the great bulk of the imagery taken with such equipment, was classified. This made it very difficult to find out just how this equipment could be used and how effective it might be in many non-military activities, notably petroleum exploration, forest fire detection and fighting, crop disease surveys, volcanology, water pollution, to name just a few. The report further indicated that overall values to the national economy, which would accrue from greater freedom of use of the equipment and imagery, would be significant. Consequently, it was concluded by interested parties outside DOD that those general values should be placed in the balance with the values resulting to national defense from security classifications. The result, so it was felt, would be to declassify some of the equipment and the imagery which was then in existence, resulting in an ultimate net national benefit.

At about this same time, in March 1963, Dr. Harold Brown, then the Director of Defense Research and Engineering, issued a memorandum recommending priority emphasis on establishing an unclassified joint basic research program leading to the development of new and existing sensors for non-military uses. Further, Dr. Brown recommended that all sensor materials, which did not involve military or "sensitive type" information, be declassified and released to the scientific and technical community.

In May 1964, Dr. Eugene Fubini, then Deputy Director of Defense Research and Engineering, as a result of the Institute study, Dr. Brown's memorandum, and a further detailed study by a tri-Service group under the auspices of the Air Force Cambridge Research Laboratories, requested the Deputy Assistant Secretary of Defense (Security Policy) to establish an *ad hoc* group to consider the security classification of equipment and data mentioned in the March 1963 memorandum. Dr. Fubini also recommended that this group or another one prepare a joint Service manual covering the security classification of research and development work in remote sensing. A suggested base for this work was a joint policy developed under the auspices of the Joint Chiefs of Staff titled, "Joint Policy for the Classification of Infrared, Visible and Ultraviolet Equipment, Components, and Information," issued in February 1963.

In July 1964, the Director for Classification Management, in the Office of the Deputy Assistant Secretary of Defense (Security Policy), requested the Office of the Director, Defense Research and Engineering, the three Services and the Defense Intelligence Agency to name technical personnel to an *ad hoc* working group. In its earliest deliberations, because of the pressure resulting from the interests of other government agencies and private organizations, the group concentrated on the security classifications to be assigned to airborne infrared scanning systems and imagery obtained from such systems.

An analysis of the Joint Chiefs of Staff policy of February 1963 showed that it applied classifications largely on the basis of the quality of equipment performance in comparison with other systems. For example, the basic standards for classifying at the Secret level were that the equipment could reveal "an operational capability of outstanding tactical value," or "a capability markedly superior to that of existing Confidential equipment of the same general type or class," or the equipment contained "a component part which, because of its use in other equipment, is classified Secret."

At first reading these standards sound all right, particularly when the technical experts on the *ad hoc* group noted that there had to be a finding that unauthorized disclosure of the performance capabilities would result in serious damage to the interests of national defense. But these standards were too inexact by which to measure or evaluate the classification which should be applied to all such systems.

Further, the joint policy provided no criteria for downgrading or declassifying some of the older systems which by that time were obsolete by the critical information involved in military standards. As it was put by a member of the *ad hoc* group: "Everyone was waiting for someone else to act." This was the general situation facing the *ad hoc* working group when it began its work.

In this field of infrared scanners it has been said that every piece of equipment has a military capability. Therefore, while a particular piece of equipment may be obsolete by U.S. military standards, it might be useful to other nations which had not done any research or development of such systems. Also, the working group noted, if one system were declassified and its operating capabilities known, then it would be obvious that the United States had some equipment with greater military capabilities. Not only would it be advisable to classify performance capabilities at some level, but the highly specialized technology necessary to successful production of operational equipment, which had been developed under DOD contracts, had to be considered. Without this knowledge the technical experts agreed that there was a lead time of two years and up from the beginning of a research and development effort to the development and debugging of an equipment of operational quality.

If one were to stop at this point, all these infrared imaging systems probably should be classified and the imagery, too. This would be an easy way out, but it is not nearly good enough to meet our military operational requirements and the insistent requests to make this equipment and imagery available for a multitude of non-military uses, to say nothing of the necessity for applying established classification principles far more precisely.

One of the fundamental principles of a sound classification system is to identify precisely what information warrants protection, and to apply our resources to protecting only that kind of information. In applying this principle, the technical experts, who met during the summer and fall of 1965, readily agreed on the critical elements of infrared imaging systems, namely, the V/H ratio, spatial and thermal resolution.

These elements will be recognized as the critical operating capabilities of infrared imaging systems. It is easy to see that knowledge of these capabilities for any infrared system would reduce or eliminate, to some extent at least, whatever military advantages would accrue to our forces in the field by having this equipment available in a given locality. Knowlege of these capabilities would enable an enemy to judge what we were capable of learning of reconnaissance flights at night, as well as during the day. So long as our capabilities are not known, our forces have some kind of an advantage that is worth protecting. Countermeasures have not been mentioned, but it is obvious what the enemy might do to protect himself if he knew we were using the equipment, and what kind of information the equipment is capable of providing.

When talking about classifying information pertaining to technical equipment, we hear the term "state of the art" used frequently as a measure or standard for classification. There are many levels of state of the art. First, there is the open, publicly known degree of attainment; next, the unknown or classified level of achievement in U.S. systems; next, our knowledge of foreign achievements. Technical intelligence plays a large part in determining state of the art for classification purposes. It becomes quite involved when we try to determine what we know of foreign developments, what foreigners know of our developments, and what we think foreigners know of what we know of their developments.

For obvious security reasons, this article cannot discuss intelligence estimates. Suffice it to say that our experts, in taking a look at all that has been published concerning infrared imaging systems, particularly the IRE proceedings on infrared in 1959 and the 1962 and 1964 symposia on Remote Sensing, came to the conclusions that:

- The whole world knows the fundamentals of passive infrared scanning imaging systems.
- The whole world knows the United States has developed operational equipment.
- There is a measurable level of attainment which can be deduced from those two facts.

To complicate further the job of deciding what should be classified about these systems is the often-stated fact that all of the significant components for one of these systems can be purchased on the open market. This meant to our experts that any competent group of engineers could obtain the necessary parts and, in a reasonable time frame, could produce an operable piece of equipment. The estimates as to how long this would take varied from one to three years. An independent group of engineers, in a study prepared by Battelle Memorial Institute for the Advanced Research Projects Agency, concluded one to several years depending on the degree of operational excellence desired.

As a preliminary move, our experts decided that the amount of data already published indicated that our military equipment was capable of at least a V/H ratio of .25 radians per second, a thermal resolution of about a quarter degree Centigrade, and a spatial resolution of four milliradians. They accepted this as a reasonable measure of the known state of the art.

As anyone familiar with the workings of these systems knows, this statement of known levels of performance is not the last consideration. There are considerable trade-offs possible which may result in great increases in one parameter at the expense of others. There is a direct mathematical relationship between these factors. To give effect to this trade-off possibility, the experts devised a formula expressing this mathematical relationship. At first it did not include the total field of view (FOV) but, ultimately, it came out as the ratio of the square root of the product of the V/H ratio, expressed in radians per second, and the total FOV in radians over the product of thermal resolution (delta T) in degrees Centigrade and the square of the spatial resolution (alpha) in milliradians.

$$\frac{\sqrt{(V/H)\ (FOV)}}{(\Delta T)\ (\alpha)^2}$$

To put this formula to practical use, the experts entered the data which they felt represented the known capabilities of our military equipment and came out with a figure of 4.5×10^5, termed the "Order of Merit." This to their minds represented a precise, usable figure, an Order of Merit, by which to measure the relative total capabilities of any particular system in comparison with others. Total inherent capabilities above that figure would require classification of those capabilities.

Application of this formula to determine whether a particular system may have operating capabilities requiring classification requires determination of optimum capabilities. The V/H ratio is based on feet per second per foot. The total field of view, the total scan angle, is the double angle from the vertical expressed in radians. Delta T is defined as the "noise equivalent temperature difference" relative to 300° K, and is that temperature difference between adjacent objects which produces at the output terminals of the electronic system an electrical signal of Root Mean Square value equal to the RMS value of the electrical noise of the system. This figure is determined under laboratory conditions when the object radiates as a black body and subtends an angle equal to the spatial resolution (alpha) of the system. Spatial resolution is the fineness of target detail which can be distinguished in the imagery and is defined, for the purposes of the formula, as the ratio of the smallest dimension of the sensitive area of the detector and the effective focal length of the optical system, expressed in radians (milliradians in the formula).

Insofar as I know, this is the first time an attempt has been made to develop a mathematical measure of capabilities as a means for making classification determinations. It is, however, not the only basis for determining whether a particular piece of infrared scanning equipment should be classified. It covers only operational performance capabilities. Also to be considered are other things—manufacturing technology, unique to these systems and essential to successful production of operating equipment; and materials or components representing improvements, unique to these systems or to other infrared equipment, which contribute to the military or defense advantages to be realized from the systems. Items of hardware, including the complete end items, the system package, warrant classification by reason of the classified information which they reveal or which can be obtained from them.

So much for the systems, the hardware. Imagery taken by these systems can reveal much to the expert eye—not from a photointerpreter standpoint as to what can be read from the imagery, but certain of the critical operating capabilities which can be gleaned from technical analysis. Specifically, it is not too difficult to determine, with reasonable scientific accuracy, the thermal and spatial resolutions realized in the particular operation. If those figures are in the classified zone, then the imagery would have to be classified. The main use of the Order of Merit formula lies in deciding whether certain imagery should be classified. As a general rule, if at the time imagery is obtained, the total attained operating capabilities of the equipment result in an Order of Merit below the figure of 4.5×10^5, the imagery would not have to be classified to protect equipment capabilities.

To sum up, DOD Instruction 5210.51 establishes a bench-mark in classification guidance. It applies to the fullest the basic requirement that it is information that is classified. Equipment capabilities are information. In this instruction for the first time a mathematical basis is expressed to assist in making classification determinations of equipment capabilities. Broadly speaking, end items on infrared imaging equipment are classified because of the information they contain and reveal.

Detectors have been developed to the point where they are classified only if they are unique, and represent an advancement which makes the equipment more useful militarily. The kinds of material used have been fairly standardized. The atmospheric windows used, *i.e.*, the 3.5-5 and the 8-14 micron regions, are no longer considered significant, except as they might reveal the purpose of a particular intelligence or reconnaissance mission, so it is generally no longer necessary to classify the fact that an InSb or a Ge: Hg detector is used in a particular system. The time of day or night when imagery is taken is no longer considered significant.

To date DOD has not yet declassified any equipments developed under DOD contract or other systems related to such military systems. Existing systems are being evaluated to determine whether any can be declassified.

Because of their overall military usefulness, DOD considers all airborne passive scanning infrared imaging systems and related technical data to come within the coverage of the State Department's International Traffic in Arms Regulation (the munitions control regulation) and the Expert Control laws. DOD recognizes the possible values of these systems to non-military users and, subject to the overall interests of national defense, has taken the steps mentioned to classify more precisely the information pertaining to those systems. By and large, we believe we have arrived at a sound practical basis for classification which ultimately will make most imagery and some equipment available for non-military uses.

Calendar of Events

Sept. 3–4: Greater Cleveland Air Show, Burke Lakefront Airport, Cleveland, Ohio.

Sept. 4–8: Symposium on Automatic Control in Space, Vienna, Austria.

Sept. 5–9: National Association of Photo-Lithographers Meeting, Boston, Mass.

Sept. 11–13: American Institute of Aeronautics and Astronautics Electric Propulsion and Plasmadynamics Specialist Conference, Antlers Plaza Hotel, Colorado Springs, Colo.

Sept. 11–13: Air Force Association Annual Fall Meeting, "1967 Aerospace Briefings & Display," Sheraton-Park Hotel, Washington, D.C.

Sept. 12–14: Annual Seminar of the American Society for Industrial Security, Ambassador Hotel, Los Angeles, Calif.

Sept. 13–14: Institute of Electrical and Electronic Engineers Meeting, Detroit, Mich.

Sept. 16–17: Midwestern Aviation and Space Exposition, Willow Run Airport, Detroit, Mich.

Sept. 19: National AeroSpace Services Association Sixth Annual USAF Contract Aerospace Service Symposium, Imperial House North, Dayton, Ohio.

Sept. 19–20: Army Munitions Command/National Security Industrial Association Advanced Planning Briefings for Industry, Washington, D.C.

Sept. 19–22: Electronic Industries Association Configuration Management Workshop, Denver, Colo.

Sept. 23–27: American Institute of Supply Association Meeting, Boston, Mass.

Sept. 25–28: Human Factors Society Meeting, Boston, Mass.

Sept. 27–28: National Security Industrial Association Procurement Conference, Washington, D.C.

Sept. 29–Oct. 1: National Institute of Government Purchasing Meeting, Washington, D.C.

Oct. 1–4: American Public Works Association Meeting, Boston, Mass.

Oct. 1–4: National Defense Transportation Association Meeting, Los Angeles, Calif.

Oct. 9–10: 15th Joint Engineering Management Conference, San Francisco, Calif.

Oct. 9–11: Association of the U.S. Army Meeting, Washington, D.C.

Oct. 9–11: Defense Supply Association Meeting, Washington, D.C.

Oct. 9–12: National Business Aircraft Association Meeting, Boston, Mass.

Oct. 10–12: Cleveland-Navy-National Security Industrial Association Scientific and Procurement Conference, Cleveland, Ohio.

Oct. 11–13: Army Aviation Association of America Meeting, Washington, D.C.

Oct. 16–17: Society of Photo-Optical Instrumentation Engineers Laser Range Instrumentation Seminar, Hilton Inn, El Paso, Tex.

Oct. 16–18: Institute of Electrical and Electronic Engineers Aerospace Systems Technical Convention, Sheraton-Park Hotel, Washington, D.C.

Oct. 16–20: 10th Anglo-American Conference, Los Angeles, Calif.

Oct. 17–19: Lubrication Conference, Chicago, Ill.

Oct. 18–19: National Security Industrial Association R&D Symposium, Washington, D.C.

Oct. 23–25: National Electronics Conference, International Amphitheatre, Chicago, Ill.

Oct. 23–27: American Institute of Aeronautics and Astronautics Fourth Annual Meeting and Technical Display, Anaheim, Claif.

Oct. 25–27: Electric Council of New England Meeting, Boston, Mass.

Oct. 29–Nov. 3: Civil Defense Council Meeting, Miami Beach, Fla.

Nov. 1–3: National Security Industrial Association Meeting, Patrick AFB, Fla.

Nov. 1–3: Northeast Electronic Research and Engineering Meeting, Boston, Mass.

Nov. 13–15: Conference on Electrical Techniques in Medicine and Biology, Boston, Mass.

Nov. 14–16: American Society of Tool and Manufacturing Engineers—Regional Exposition, Sheraton-Boston and War Memorial Auditorium, Boston, Mass.

SELECTED DEFENSE DEPARTMENT ECONOMIC INDICATORS

(Dollars in Millions; Manpower in Thousands; Quarters by Calendar Year)

	1966 I	II	III	IV	1967 Jan	Feb	Mar	I	Apr	May	Jun	II
I. Military Prime Contract Awards												
Aircraft	$1,945	$2,989	$2,696	$2,262	$ 784	$ 788	$ 530	$2,102	$ 432	$1,240	$1,377	$3,049
Missile & Space Systems	1,040	987	1,314	861	380	361	489	1,230	300	260	606	1,166
Ships	355	491	876	239	90	418	171	679	72	129	206	407
Weapons & Ammunition	555	1,486	692	940	346	215	257	818	279	518	972	1,769
Electr. & Communications Eqpt.	918	1,574	666	915	377	265	329	971	480	338	1,030	1,848
Other Hard Goods	843	1,842	660	1,029	267	305	343	915	298	362	904	1,564
Soft Goods	709	922	1,078	989	251	193	194	638	171	199	282	652
Construction	207	392	198	150	106	59	67	232	126	160	340	626
All Other	1,406	1,963	2,356	1,639	534	575	496	1,605	517	507	963	1,987
Total (Excl. of work outside U.S.)	7,978	12,646	10,536	9,024	3,135	3,179	2,876	9,190	2,675	3,713	6,680	13,068
Total, Seasonally Adjusted	8,703	10,144	10,716	10,149	3,338	3,849	2,984	10,171	2,920	4,121	3,626	10,667
Work Outside U.S.	521	1,195	856	672	183	112	158	453	227	228	379	834
II. Gross Obligations Incurred												
Operations	8,326	9,604	10,426	9,702	3,495	3,226	3,508	10,229	3,664	3,531		
Procurement	4,374	8,539	5,368	5,276	1,738	1,451	1,924	5,113	1,801	2,485		
Other	2,429	3,470	3,453	2,230	823	774	922	2,519	726	1,130		
Total	15,129	21,613	19,247	17,208	6,056	5,451	6,354	17,861	6,191	7,146		
III. Gross Unpaid Obligations Outstanding												
Operations	3,828	3,867	4,792	5,024	5,041	4,892	4,644	4,644	4,761	4,765		
Procurement	18,023	21,944	22,736	23,173	23,134	22,982	22,780	22,780	22,613	22,947		
Other	5,898	6,709	8,051	7,627	7,557	7,469	7,228	7,228	7,159	7,334		
Total	24,749	32,520	35,579	35,824	35,732	35,343	34,652	34,652	34,533	35,046		
IV. Net Expenditures												
Operations	7,689	9,076	8,968	9,087	3,267	3,219	3,516	10,002	3,416	3,335	3,745(p)	10,496(p)
Procurement	3,651	3,886	4,392	4,264	1,680	1,491	1,903	5,074	1,783	1,850	1,702(p)	5,335(p)
Other	2,757	2,647	2,484	3,092	1,015	887	1,277	3,179	918	749	399(p)	2,066(p)
Total	14,097	15,609	15,844	16,443	5,962	5,597	6,696	18,255	6,117	5,934	5,846(p)	17,897(p)
V. DOD Personal Compensation												
Military	3,181	3,249	3,551	3,606	1,200	1,221	1,203	3,624	1,230	1,196		
Civilian	1,937	2,015	2,105	2,135	733	666	764	2,163	700(r)	776(p)	766(p)	2,242(p)
Total	5,118	5,264	5,656	5,741	1,933	1,887	1,967	5,787	1,930(r)	1,972(p)		
VI. Outstanding Payments												
Advance Payments	66	79	90	83				92				
Progress Payments	4,402	4,346	4,750	5,461				5,981				
V Loans	53	51	52	55				112				
Total	4,521	4,476	4,892	5,599				6,185				
VII. Strength (Manpower)												
Military	2,969	3,094	3,229	3,334	3,357	3,368	3,371	3,371	3,371	3,368	3,375(p)	3,375(p)
Civilian	1,088	1,138	1,184	1,230	1,246	1,260	1,268	1,268	1,273	1,274	1,303(p)	1,303(p)

p—preliminary.
r—revised.

Directorate for Statistical Services, OASD (Comptroller)
4 August 1967

U.S.-Australian Cooperative Logistics Arrangements

Leighton A. Cain

Australia, a nation alive to the problem of preparedness in Southeast Asia and the need to provide for its defenses, has made arrangements for the purchase of several hundred million dollars of military products from the United States.

Defense Policy.

Australia's national defense objectives are broadly:

- To provide for the security of Australia and its island territories.
- To pursue close friendship and cooperation with non-communist Asian countries.
- To seek support, particularly of Great Britain and the United States, in promoting cooperative arrangements for collective security in the Southeast Asia area and for the defense and security of Australia.
- To counter communist aggression in Southeast Asia.
- To support the development of the United Nations as an effective instrument of collective security.

Since World War II, and more particularly in recent years, Australia's defense has been characterized by a progressive increase in international defense responsibilities and commitments.

The collective security arrangements in which Australia participates are SEATO (Southeast Asia Treaty Organization), ANZUS (Australia, New Zealand and United States), and Commonwealth defense arrangements, such as ANZAM (Australia, New Zealand and Malaysia).

These are a fundamental part of current Australian strategic thinking and outlook. Much of Australia's defense effort continues to be directed to supporting these alliances in a measure commensurate with its national interests and resources, while at the same time making appropriate provisions for the immediate defense of Australia and its territories in the light of assessed threats.

Defense Program.

The government has followed a policy of progressive development of Australia's armed forces and substantial additions have been made to the defense program in recent years.

In March 1957, the Australian government announced a new defense program which would place emphasis on "mobility, hitting power, and modern equipment." It included a decision to make Australian land and air weapons compatible with U.S. equipment, a marked departure from Australia's traditional military connections with the United Kingdom. In November 1959, a further plan was announced, the main features of which were suspension of compulsory military training, coupled with a 35 percent increase in the strength of the regular army; disbandment in 1963 of the fleet air arm; and reorganization of army operational units on the pattern of the U.S. Army's then pentomic division.

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Arrangements were completed in June 1961 for the construction of two new destroyers in the United States, the vessels to be equipped with the most modern offensive and defensive equipment. Agreement on construction of a third destroyer was reached in 1963. In the same year Prime Minister Menzies announced an increase of 15 percent in defense expenditures over the next five years. In 1964 a further large increase in defense spending was announced, and Australia contracted to buy 24 F–111 aircraft.

Australia's acceptance of overseas obligations since World War II, and the deterioration of the situation in Southeast Asia during the last few years, have provided the incentive for improvement of Australia's military forces. A program of accelerated improvement was announced in November 1964. This program included an increase in armed forces strength from 50,000 in 1964 to 75,000 by the end of 1967, through the introduction of conscription for overseas service for the first time in Australian history; and the re-equipping of the services. Toward these ends, Australia's defense expenditures have increased from $480 million in 1963 to $1,120 million in 1967, an increase of 134 percent.

Australia is also a member of the European Launcher Development Organization (ELDO). The facilities at the Woomera Rocket Range, in south Australia, and the technical experience of its staff are being used in a program scheduled to launch a test satellite into orbit by 1969.

Australia recognizes the need for cooperation in world affairs as evidenced by its participation in collective security arrangements and agreements.

U.S.-Australian Cooperative Logistics Arrangements.

A mutual defense agreement between the United States and Australia was signed Feb. 20, 1951. No grant aid, however, was required and all assistance made available has been financed and paid for by Australia, including purchases from the United States under its military sales program.

Since 1951 the United States and Australia have concluded more than a dozen treaty arrangements concerning such matters as tracking stations, communications stations, status of forces, naval matters, mutual weapons development programs, weather stations and security. In addition, cooperative logistics arrangements and credit arrangements have been consummated to cover purchase of defense articles and defense services from the United States. Security procedures for industrial operations were also promulgated through an exchange of defense letters.

During the period FY 1962–1967, Australia placed military sales orders, or commitments to buy, with the United States amounting to several hundred million dollars. The program is concrete evidence of Australian recognition of the necessity for military preparedness and the need for closer U.S.-Australian cooperation in Southeast Asia. The bulk of these sales are under credit arrangements with the United States.

In addition to destroyers and F-111 aircraft, major purchases by Australia have included S–2E, C–130, P–3B and A–4G aircraft, helicopters, armored personnel carriers and other weapon systems.

The current logistic arrangement between Australia and the United States, agreed upon in February 1965, is designed to cover Australian purchases of military equipment for force improvement, as well as for some force maintenance during the period FY 1966–1968.

A cooperative support agreement was also consummated in February 1965. This arrangement permits Australia to obtain logistic materiel and services for its armed forces equivalent in timeliness and effectiveness to that provided the U.S. Armed Forces. Subsequently, individual arrangements were made between the U.S. and Australian Armed Forces to provide such support for specific major weapon systems.

These arrangements include provision for credit of up to $450 million for defense articles and services to be provided through U.S. Government agencies or from private sources in the United States.

A U.S.-Australian defense space research facility has been established in Australia. This activity will engage in a variety of research projects and the results obtained will be available to both countries. It will be a joint operation of the Australian and the U.S. Defense Departments. Australian sub-contractors will share in the construction.

Australia has further contributed to space research by becoming an important base for six tracking stations built for the U.S. National Aeronautics and Space Administration (NASA). The six stations are associated with earth-orbiting satellites, deep space probes, and Project Apollo. The costs of building, equipping and operating the stations are borne by NASA, while the stations are managed, maintained and operated by the Australian Department of Supply.

Summary.

The U.S. Foreign Military Sales Program for Australia represents a manifestation of close U.S.-Australian politico-military interests, a result of the growing Australian recognition of the severity of the Southeast Asia problem, and cooperation in the broadest field of international finance.

Large-scale Australian purchases of U.S. military equipment offer advantages to both the United States and Australia. For the United States, the sale of major items of military equipment contributes not only toward the attainment of important policy objectives, such as increased standardization and commonality of free world military systems and equipment, but it also provides a friendly foreign nation with an opportunity to acquire the best weapons at an economical price while, at the same time, helping to reduce our balance of payments deficit. For Australia, it provides the best weapons at the lowest cost, under favorable financing arrangements, and with assured continued support; it enhances its ability to participate in joint operations and actions with U.S. forces with the commonality of equipment involved; and it opens the door for future joint operation and maintenance activities, co-production projects, and U.S. procurements in Australia.

Navy Lab Tests Inflatable Tent

An inflatable shelter which can be used in areas of extreme heat or cold is being tested by technicians at the Environmental Test Laboratory, Naval Missile Center, Point Mugu, Calif.

Upon completion of testing and evaluation, the structures will be sent to South Vietnam for use by Fleet Marine Forces to house data processing equipment and personnel.

During the testing program, the structure will be subjected to temperatures of up to 135 degrees Fahrenheit and down to minus 40 degrees Fahrenheit in the laboratory's large climate chamber.

The structure is 24 feet square and 10 feet tall. Sections of the superstructure are made of cloth coated with polyurethane. When inflated they provide a wall nine inches thick. Nylon threads between the inner and outer panels of each wall section maintain uniform thickness and rigidity.

Because the walls are made in sections a puncture in one location will not cause the entire structure to collapse. According to the Dewey Corp., manufacturer of the structure, as many as three-quarters of the wall panels can be punctured and the structure will retain its shape.

The universal shelter is being considered for such tactical uses as operation centers, command posts, field dental and hospital use, and for other general utility applications.

R. W. Canon is head of the Environmental Test Laboratory at Point Mugu.

ABOUT PEOPLE

DEPARTMENT OF DEFENSE

The following assignments have been announced by the Defense Supply Agency: **Maj. Gen. John Goshorn, USA,** Dep. Dir., (Contract Administration); **RAdm. Ira F. Haddock, (SC), USN,** Asst. Dir., (Plans, Programs and Systems); **Brig. Gen. John A. Brooks III, USAF,** Exec. Dir., (Technical and Logistics Services); **Maj Gen. Emmett M. Tally Jr., USAF,** Commander, Defense Construction Supply Center, Dayton, Ohio; **Capt. Grover C. Heffner, (SC), USN,** Commander, Defense Industrial Supply Center, Philadelphia, Pa., with the rank of rear admiral; and **Col. Robert I. Ciraldo, USA,** Inspector General.

RAdm. Elliott Bloxom, USN, has been appointed Dep. Commander (Operations), Military Traffic Management and Terminal Service.

Capt. John A. Davenport, USN, has been assigned Chief, Business & Labor Div., Office of Asst. Secretary of Defense (Public Affairs).

DEPARTMENT OF THE ARMY

Brig. Gen. William A. Becker is the new Dep. Dir., (Research and Laboratories), Army Materiel Command. He relieved **Col. Harvey E. Sheppard,** who served as acting Dep. Dir. from October 1966.

The following assignments have been announced by the Army Combat Developments Command, Fort Belvoir, Va.: **Col. Ernest W. Chapman,** Dep. Chief of Staff (Development); **Col. William S. Barrett,** Dir. (Plans); **Col. Charles B. Hazeltine Jr.,** Dir. (Evaluation); **Col. Charles T. Caprino,** Comptroller; **Col. James T. Avery Jr.,** Commanding Officer, Institute of Special Studies; **Col. Norman Farrell,** Commanding Officer, Institute of Land Combat; **Col. Francis J. Kelly,** Commanding Officer, Combat Support Group.

Col. Thomas W. Mellen is the new Dep. Dir. (Development), Office of Research and Development, U.S. Army Headquarters, Washington, D.C.

Lt. Col. Joseph J. Rochefort Jr., has been assigned as Project Manager, Engine Generators, at the U.S. Army Mobility Equipment Command's Engineer Research and Development Laboratories, Fort Belvoir, Va.

DEPARTMENT OF THE NAVY

VAdm. Bernard A. Cleary has been assigned as Dir., Program Planning, in the Office of the Chief of Naval Operations.

RAdm. Richard B. Lynch has succeeded **RAdm. William A. Sunderland** as Commander, Hawaiian Sea Front-

(Continued on page 30)

Paul R. Ignatius, who has served as Assistant Secretary of Defense (Installations and Logistics) since 1964, has been nominated to be the new Secretary of the Navy. He succeeds Paul H. Nitze who was appointed Deputy Secretary of Defense. Mr. Ignatius has served with the Defense Department since 1961 when he became Assistant Secretary of the Army (Installations and Logistics).

Admiral Thomas H. Moorer was sworn in as Chief of Naval Operations on Aug. 1 relieving retiring Admiral David L. McDonald. Prior to the new assignment he served as Supreme Allied Commander Atlantic under the North Atlantic Treaty Organization, and as Commander in Chief, U.S. (unified) Atlantic Command and the U.S. Atlantic Fleet. Admiral Moorer is a 1933 graduate of the U.S. Naval Academy.

Thomas D. Morris, nominated to the position of Assistant Secretary of Defense (Installations and Logistics) to succeed Paul R. Ignatius, returns to the post in which he served from Jan. 1961 to Dec. 1964. Mr Morris has been Assistant Secretary of Defense (Manpower) since Oct. 1965. He was a member of the New York firm of Cresap, McCormick and Paget prior to the Manpower appointment.

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LTC Salvatore Fede 54635 2D600

MEETINGS AND SYMPOSIA

SEPTEMBER

International Symposium on **Information Theory**, Sept 11–15, at Athens, Greece. Sponsors: Air Force Office of Scientific Research, Information Theory Group of the Institute of Electrical and Electronics Engineers and the International Radio Scientific Union. Contact: Lt. Col. B. R. Agins, (SRMA), Air Force Office of Scientific Research, 1400 Wilson Blvd., Arlington, Va., 22209, Phone (202) OXford 4–5261.

International Symposium on **Materials—Key to Effective Use of the Sea**, Sept. 12–14, at the Statler-Hilton Hotel, New York, N.Y. Co-sponsors: Naval Applied Science Laboratory and the Polytechnic Institute of Brooklyn, N.Y. Contact: D. H. Kallas, Associate Technical Director, Naval Applied Science Laboratory, Flushing and Washington Avenues, Brooklyn, N.Y. 11251.

Advanced **Composite Structures** Symposium, Sept. 19–21, at the Hilton Hotel, Denver, Colo. Sponsor: Air Force Materials Laboratory. Contact: Mr. Tomashot, (MAC), Air Force Materials Laboratory, Wright-Patterson AFB, Ohio 45433, Phone (513) 253–7111, Ext. 55317.

Second International **Buoy Technology** Symposium and Exposition, Sept. 18–20, at the Washington-Hilton Hotel, Washington, D.C. Sponsor: Marine Technology Society with participation by American Meteorological Society. Contact: Buoy Committee, Marine Technology Society, 1030 Fifteenth St. NW, Washington, D.C. 20005, phone (202) 296–6773.

Eighth Symposium on **Physics and Nondestructive Testing**, Sept. 19–21, at Dayton, Ohio. Sponsor: Air Force Materials Laboratory, Wright-Patterson AFB, Ohio 45433.

Seventh Annual National Conference on **Environmental Effects on Aircraft and Propulsion Systems**, Sept. 25–27, at the Nassau Inn, Princeton, N.J. Contact: Robert A. Reale, Naval Air Turbine Test Station, 1440 Parkway Ave., Trenton, N.J. 08628, Phone (609) 882–1414, Ext. 224.

Joint Power Generation Conference, Sept 24–28, at the Statler-Hilton Hotel, Detroit, Mich. Co-sponsors: Institute of Electrical and Electronics Engineers and the American Society of Mechanical Engineers. Contact: Carl Shabtach, General Electric Co., Schenectady, N.Y. 12301.

Fourth International Conference on **Atmospheric and Space Electricity**, Sept. 29–Oct. 6, at Lucerne, Switzerland. Sponsors: Air Force Cambridge Research Laboratories, Army, Navy, National Scence Foundation and National Aeronautics and Space Administration. Contact: M. B. Gilbert, (CRTE), Air Force Cambridge Research Laboratories, L. G. Hanscom Field, Mass. 01731, Phone (617) 274–6100, Ext. 3633.

OCTOBER

Twenty-second Annual **Transportation and Logistics** Forum, Oct. 3–6, at the Biltmore Hotel, Los Angeles, Calif. Sponsor: National Defense Transportation Association. Contact: Les Richards, 3416 S. La Cienega Blvd., Los Angeles, Calif. 90016.

Conference on **Reinforced Metal Matrix Composites**, Oct. 10–12, at Wright-Patterson AFB, Ohio. Co-sponsors: Air Force Materials Laboratory and the University of Dayton.

Eleventh Annual **Organic Chemistry** Conference, Oct. 12–13, at Natick, Mass. Sponsors: National Academy of Science-National Research Council, Advisory Board on Military Personnel Supplies, and Organic Chemistry Laboratory, Pioneering Research Div., Army Natick Laboratories. Contact: Dr. L. Long Jr., Head, Organic Chemistry Lab, (PRD), Army Natick Laboratories, Natick, Mass. 01760, Phone (617) 653–1000, Ext. 414.

Conference on the **Exploding Wire Phenomenon**, Oct. 18–20, at Boston, Mass. Sponsor: Air Force Cambridge Research Laboratories. Contact: W. G. Chace, (CRFA), Air Force Cambridge Research Laboratories, L. G. Hanscom Field, Mass. 01730, Phone (617) 274–6100, Ext. 4926.

Mass Transport in Oxides Conference, Oct. 22–25, at Gaithersburg, Md. Sponsor: Advanced Research Projects Agency. Contact: Dr. John B. Wachtman, Inorganic Materials Div., National Bureau of Standards, Washington, D.C. 20234, Phone (301) 921-2901.

Conference on **Unguided Rocket Ballistics Meteorology**, Oct. 30–Nov. 1, at New Mexico State University, Las Cruces, N.M. Sponsor: Army Electronics Command. Contact: B. E. Britain, Atmospheric Sciences Office, Atmospheric Laboratory, USAECOM, White Sands, N.M. 88002, Phone (505) 338–1006.

NOVEMBER

1967 Conference on **Speech Communication and Processing**, Nov. 6–8, at Boston, Mass. Co-sponsors: Air Force Cambridge Research Laboratories and the Institute of Electrical and Electronics Engineers. Contact: C. P. Smith, (CRBS), Air Force Cambridge Research Laboratories, L. G. Hanscom Field, Mass. 01730, Phone (617) 274–6100, Ext. 3712.

Applied Superconductivity Conference, Nov 6–8, at Austin, Tex. Sponsors: Army Research Office, University of Texas, NASA, Air Force Office of Scientific Research and the Office of Naval Research. Contact: W. H. J. Hartwig, Electronic Materials Research Laboratory, University of Texas, Austin, Tex. 78712.

1967 Conference on **Speech Processing**, Nov. 13–15, at the Hotel Somerset, Boston, Mass. Co-sponsors: Air Force Cambridge Research Laboraories and the Institute of Electrical and Electronics Engineers. Contact: Calwdell P. Smith, (CRBS), Air Force Cambridge Research Laboratories, L. G. Hanscom Field, Mass. 01731, Phone (617) 274–6100, Ext. 2712.

Decomposition of Organo Metallic Comp. to Refractory Ceramics, Metals and Metal Alloys, Nov. 28–30, at the Sheraton-Dayton Hotel, Dayton, Ohio. Sponsor: Air Force Materials Laboratory. Contact: Dr. Lynch, (MAMC), Air Force Materials Laboratory, Wright-Patterson AFB, Ohio 45433, Phone (513) 253-7111, Ext. 54145.

FROM THE SPEAKERS ROSTRUM

Address by Hon Robert H. Charles, Asst. Secretary of the Air Force (Installations & Logistics), at the Annual Meeting of the Forging Industry Association, White Sulphur Springs, W. Va., May 26, 1967.

Product Lead Time Problems

As you well know, we have been through some trying times together in satisfying our production needs for Southeast Asia. Despite my long background in the aerospace industry, I for one did not fully appreciate the criticality of forgings in such a situation.

Early in 1966, we were confronted with a logistical paradox. While we sought greater program flexibility and accelerated production, most of our system contractors were quoting longer lead time which translated into slipped delivery schedules. Our analysis of the problem indicated that forgings were the pacing items, and that their lead times had doubled, typically, in the previous year.

To come to grips with this problem, a meeting was called in the Pentagon last October with representatives of the aerospace and forging industries. Your counsel and cooperation then, and in the months following, have been most gratifying, and I thank you therefor. Perhaps the most important accomplishment of these efforts has been a much clearer understanding of each other's problems. It has become evident that the finger could not be pointed solely at the forging industry. There were actions that had to be taken by the users and the Government as well. Some 12 recommendations were listed in the final DOD-industry report, and we have attempted to follow these up on a continuing basis.

I do not, by any means, want to imply that we have the problem licked, but progress is being made. The most recent reports on forging lead times, as reflected in surveys by the Aerospace Industries Association (AIA), indicate a leveling off of the rising trend, with improvement in many areas. I like to think that our joint concern has had a lot to do with this improvement.

My reference to the AIA surveys brings me to a major point I want to leave with you today. Lead times for various types of aerospace quality forgings are shown as ranging from 11 to 16 weeks as of August 1965, and from 24 to 31 weeks as of March 1967. We are advised that the 1965 figure may be depressed because of unusual conditions at that time, and that the 1967 figure may be high due to the boom in aircraft production. The norm is indicated to be somewhere between the two levels. If we accept this, it means that we should normally expect to wait from 17 to 24 weeks for a forging. Four to five and one-half months! Even after receipt, a difficult and time-consuming machining job may be required to obtain the precision needed for the final part. There is some argument as to these numbers, but in any event I believe that we can do better—in fact, if we don't do better in the future, we may find forgings replaced by parts made by other processes. Even today, a great deal of development effort is being expended in this direction.

Hon. Robert H. Charles

Earlier this year I publicly discussed what I considered to be the adverse effects of long production lead times: they limit our response to changing world conditions and to the rapidly shifting requirements of defense, increase the possibility of accumulating unneeded or obsolescent inventories, and inhibit modernization of our forces. This accumulation of unneeded or obsolescent inventories deserves further exposition.

One of the determinants of force structure is the need for an existing pool of replacement airplanes of each type, so that those lost in combat or otherwise can be replaced at once. We must have enough to take care of attrition under the most adverse circumstances.

For example, let us assume a situation calling, at all times, for a minimum of 500 airplanes of a particular type, excluding the replacement pool. Let us also assume that this airplane is currently being produced at the rate of 15 a month, and that the maximum attrition rate, under the most adverse combat scenario, is 25 a month. Thus, the maximum net loss is 10 a month.

Now, if the production lead time—from go-ahead to delivery—were 20 months (which is faster than some aircraft today), we must have a replacement pool of 10 airplanes times 20 months, or 200 airplanes, in order to assure ourselves that our combat-ready aircraft will never fall below 500. On the other hand, if the production lead time were 12 months, for example, we would need a replacement pool of only 10 airplanes times 12 months, or 120. Thus, by reducing the lead time from 20 to 12 months, we could reduce our required inventory by 80 airplanes. If we apply this arithmetic to a fighter which costs $3 million, we are talking about saving $240 million, with no degradation of military posture, simply by reducing the lead time from 20 to 12 months.

You recognize, of course, that the assumptions in this example are over-simplified; but I think you can see why I consider long production lead times a major problem, even without considering their two other adverse effects; *i.e.*, they limit our response to changing conditions and requirements, and inhibit force modernization.

Obviously, the forging industry, with lead times between four and five and one-half months, can make only a partial contribution toward a lead-time reduction of eight months, as assumed in the example. But quality forgings, without which none of our advanced aircraft would be flying today, are of critical importance to defense products and, thus, their portion of the lead time must be examined to see if improvements can be made. I think you will agree that there are techniques and practices currently in use in many forging plants (and in other industries, too, for that matter) that have not changed in the past 20 years. This is hardly compatible with the so-called "age of automation" in which we are now living. A writer in the *Harvard Business Review* recently raised the question in even broader terms, and indicated that our overall position as world leaders in industrial technology is deteriorating. He implies that we are doing a mediocre job of coping with and taking advantage of automation.

Extensive efforts must be made to accelerate our basic manufacturing processes and, at the same time, provide maximum production flexibility. We should consider changing our thinking with respect to material control, material handling, and production scheduling to terms which reflect a continuous manufacturing operation and flow of finished parts with built-in flexibility, rather than a process-by-process scheduling of individual parts. This is the kind of production that our economy calls for today. With the high cost of labor, equipment and space, the really successful producer will be the one who gets the maximum possible output and quality from the resources he has available.

Our Harvard expert says that the task is to:

> **"Make an increasing variety of products, on shorter lead times with smaller runs, but with flawless quality. Improve our return on our investment by automating and introducing new technology in processes and materials. . . . Mechanize, but keep your schedules flexible . . ."**

He draws a well defined distinction between this concept and the old term, "mass production," which called for large volumes, low cost, and barely acceptable quality. The point is well taken, I think. We have arrived at a stage in our industrial development that is not fully recognized by many production managers. Most managers recognize the difference between shop and mass production operations, but the more sophisticated "system that can quickly adjust schedules, get new products out fast, take advantage of new technology, and produce a wider variety of products from limited facilities" represents a new idea to most of these same managers. In the forging business, it presents a real challenge, but also an opportunity.

Investment in New Process Development and Facilities

To accomplish this, substantial investments must be made in new process development and in facilities which apply advanced production techniques. While such advancements will certainly benefit defense programs, they will also benefit commercial products and may very well be the life blood of the industry in the future. Corporate risk investment is, therefore, called for. It is easy enough to sit back in a seller's market and ignore progress when the buyer comes to you; but when the economy turns, it is usually the aggressive operator who survives.

This leads me to another point that I should make. Probably you were waiting for it. That is, the question of government financing and ownership of manufacturing facilities. From the standpoint of the companies represented here, I suppose your position would be divided between the "haves" and "have nots." My own position, however, unequivocally favors private ownership. This is the only position that one can take in a true free enterprise system and, in spite of some other tendencies rampant in our society, I for one believe that this is the overriding reason for the unparalleled success of the U.S. economy.

But there are a great many government-owned facilities, including heavy forging presses; and for the benefit of the "have nots" referred to earlier, I feel I should elaborate on our policy and on our current situation.

Our basic policy is that industry will provide all facilities needed to support defense production programs. Like all policies, however, provision is made for exceptions—in this case, for situations involving high-risk defense programs impracticable for industry to support, and where substantial cost savings can be obtained. When we embarked on the heavy press program in the early 1950s, the only then conceivable use for that equipment was defense production; and you will remember that our defense budget was cut to only $9.8 billion in 1948, and remained at $14 billion or below until Korea. In fact, annual sales of the aerospace industry to the Government averaged less than $2 billion in the three pre-Korea years of 1948–50, as compared to nearly $15 billion in each of the last 10 years. We had not recognized the nature of the cold war or of our responsibilities of world leadership.

Under those circumstances, it would have been most imprudent for industry to have built those presses with its own money; although hindsight, as is so often the case, would have rendered a different verdict. But today, the situation is entirely different. We have for some time recognized the requirements of the cold war—not just Southeast Asia—and there is a booming commercial market for aircraft. Under these circumstances, I can only say that the application of our basic policy is going to be extremely firm with respect to new facilities, and we are going to seek every possible means of divesting ourselves of existing facilities for which government ownership is not required to protect current or emergency requirements.

I hope this will help to clarify some of the recent reports that DOD has come up with a new policy regarding the provision of facilities. This policy is not new, and I believe that our contractors are well aware of this. We have, for many years, been working to shift the burden for support of defense programs to private industry. I apologize for using the word "burden." It is not a burden; it is an opportunity. And I think we have made good progress in this effort. As an illustration, you might be interested in knowing that during the Korean buildup in 1951, the Air Force expended some $1.2 billion for facilities to support its production programs. In FY 1967, with a comparable military buildup, our facilities costs are about one-tenth of that. One reason for this shows up in aerospace industry plant expenditures. In 1949, they were estimated at about $50 million, in 1951 about $150 million. In 1967, the figure is now projected at $830 million. I have not seen comparable figures for the forging industry, but I have no doubt but that they would show a similar trend. Another indication of our progress is in the number of Air Force-owned, contractor-operated plants. In 1961, we had 74. Today we have 50, and several of these are in the process of disposition.

So, you see our present position on this problem is not really new, and there is no conceivable way that profits from commercial production can be affected by a radical new facilities policy, as one reporter speculated, simply because there is no new policy. The point I want to get across, however, has to do with new emphasis and positive thinking in industry that places medium and long-term government business on the same basis as commercial business as far as plant and equipment are concerned. When Boeing gets an order from TWA for airplanes, they do not ask TWA for the facilities to do the job. Likewise, when a forging company gets an order from a commercial producer, he knows that he must come up with the necessary resources or forfeit the job. Why should similar government business be any different?

The Economics of the Big Press

With respect to the proposed 200,000-ton press, as I have said before, this is a prime example of an advanced national resource which is expected to benefit both defense and commercial business. It should have a long economic life which would permit the amortization of its cost over a reasonable period of time in accordance with normal accounting procedures. There appears to be no reason why the risk of such an investment cannot be spread sufficiently in time, and among its direct customers if necessary, so that it can be provided without direct government support.

Let's take another look at the economics of this press, estimated to cost $60 million. I mentioned earlier this year an industry study which indicated that it could have reduced the cost of manufacturing 200 C–5s by nearly $70 million. Since the forgings themselves are estimated, with the press, to cost about $11 million, this represents a six-fold saving on each part forged by the big press.

Recently I noted an article in which it was estimated that there might be $30 to $40 million worth of business available for such a press each year. Thus, assuming the aforementioned six-fold saving, on an annual volume of $35 million, this press will save the customer $210 million. Certainly, in my opinion, the company or companies which provide this kind of cost saving, at their own risk, are entitled to a worthwhile profit which reflects that saving. If, in addition, the parts forged with the big press contains superior metallurgical qualities, that is so much icing on the cake.

I am told that the investment by any one company in a $60 million production facility is impossible, because it represents too large a figure in relation to any single company's net worth. Perhaps, but let me point out that where there is enough motivation, some pretty large sums are invested in production facilities. Take the airlines, for instance, whose production facilities are airplanes. Just for fun, I took the situation of five of them—Pan American, American, TWA, Eastern and Continental—as published in their annual reports. At the end of 1966, their average depreciated value of facilities was $480 million, or 2.12 times their average net worth of $226 million; their commitments to additional facilities (excluding supersonic transports) averaged $544 million or 2.4 times their net worth; and their present facilities plus commitments averaged 4.5 times their net worth. Take some elements of the aircraft manufacturing business. Boeing's existing depreciated facilities, plus commitments, currently exceed its net worth, and this does not reflect its commitment, estimated to be at least $500 million, to develop the 747.

Spreading the Risk

But let's assume that, all factors considered, this press is too much for one company. I ask again, what's wrong with spreading the risk and forming a consortium or joint enterprise for this purpose. In fact, if several companies, rather than only one, have an interest in it, there is the possibility that its utilization may be higher. In any case, I do not agree that competition for the parts produced by the press should inhibit competing companies from joining together. In the first place, if the competition for those parts is so intense that one press cannot satisfy the demand, there probably should be more than one. Secondly, the companies, who built and operated the cooperative wind tunnel at Pasadena, were competitors for its end product, namely data; yet that program was successful. Here is how it worked. Each of the aircraft companies which put up funds became entitled to tunnel time in the same ratio that its stake bore to the total. If more time were needed, it would be granted out of the unneeded time, if any, of another member of the group. Even nonmembers were permitted to use such time as was available after the requirements of all members were satisfied. The tunnel itself was operated by an independent third party—Clark Millikan of Cal Tech.

I see in the big press a striking parallel. One of the forging companies would finance as much as its corporate judgment dictated and would operate the press. The balance would be provided by those companies which used its products, and each would be entitled to a share of the time indicated by the funds thus provided. I would expect that the profit rate to the forging company, on parts produced for customers having a financial interest in the press, would reflect the degree to which the forger had committed his own funds, and I would further expect that the forger would pay something to those companies if the time spent in producing parts for non-members exceeded the forging company's *pro rata* investment.

In brief, the answer is not, as one aerospace executive is reported to have said, one of government subsidies. It is finding a way to avoid government subsidies. Make no mistake. I believe in government subsidies as much as anyone, where the national need is clear and where there is no practicable way in which it can be accomplished without subsidy. The airlines themselves are a case in point. So were the heavy presses of the early 1950s. I do not get that feeling with respect to the big press.

So I fail to see, if in fact this press will do what industry claims it will do, why industry does not finance it. And I suggest that the discipline inherent in making a profit is a marvelous arbiter. If, bearing in mind the priorities of competing demands for capital, there is a profit to be made in this press, then it will be built. If there is not, then it won't be, at least not by private industry. And if this turns out to be the case, I imagine the Government will find little profit in it either.

Features of Private Ownership

There is another wonderful feature of the private ownership of production equipment: profit can be established on a basis of efficiency, and of value to the customer, in a free market. When the customer owns these facilities, profits are "administered," if you will, and they do not accurately measure or reward efficiency. Further, because of the reduced risk, profits are properly lower than in industries where the manufacturer provides the facilities. They may even be below the point where they provide the wherewithal for research, for competent personnel, for all the other things needed for a thriving industry. So we have a chicken-and-egg problem. Government furnishing of facilities means low profits means government furnishing of facilities means low profits, etc.

Again I suggest that you get out of this rut, just as fast as you can. We will all be better off.

Now I recognize that, if only one such large press is built, the company owning it will have at least a semi-monopoly on these types of forgings. Its profits, therefore, may be subject to some limitation. And although I detest monopoly, the profit in that case should be adequate to reflect the considerable risk involved and, as indicated, to assure the resources for research, for competent personnel, and for all the other prerequisites of a healthy industry.

As a parting thought, I would like to touch briefly on some statistics that may give you a little different insight into that old saw about lack of stability in defense business. In the years 1961 through 1966, annual defense sales of the aerospace industry remained relatively level in a range between $14.5 and $16.8 billion. In fact, for the 10 years 1958 through 1967, such sales have never been below $13 billion. This talk about instability in governmental sales is true only in the context of sales above this figure, not below. During the same period, incidentally, non-defense sales increased from $3.5 to $5.8 billion. Relating this to your own business, in the years 1964, 1965 and 1966, the Forging Industry Association reports that about 30 percent of all forging shipments were made to aircraft and parts manufacturers. The next largest user of forgings was the automotive industry at about 20 percent.

Perhaps there is room for some change in the average forger's concept of the importance of defense business in his corporate growth plan.

Army Engineers Launch Fight Against Solid Waste Pollution Of Waterways

The U.S. Army Corps of Engineers has launched a nation-wide program to increase protection of navigation channels from impairment by illegal deposit of industrial wastes containing solid materials into navigable waterways.

Engineer Corps field offices have been instructed to seek out violations and apply uniform enforcement standards aimed at:

- Complete elimination, where feasible, of the discharge of industrial wastes that reduce the capacity of navigation channels.
- Reimbursement to the Government by violators for dredging costs attributable to deposition of industrial wastes.
- Obtaining agreements with industries that will protect navigation rights and provide for compensating the Government for dredging costs where illegal discharges cannot be halted immediately.

The Army's jurisdiction is limited by Federal statutes to the impairment of navigational channel capacity caused by suspended solids in industrial wastes directly discharged into navigable waters. The Corps has no authority over impairment of such channels caused by refuse matter flowing from streets and sewers and passing into navigable waters in a liquid state.

Actions within the Corps' jurisdiction will be taken in cooperation with the Federal Water Pollution Control Administration (FWPCA), the states and other agencies having jurisdiction over water pollution. Corps field offices will consult with regional FWPCA representatives wherever dredging to remove channel-clogging wastes has a water pollution impact.

The program will include a nationwide survey to identify violations. Also, the Corps' Chicago district has a study under way to develop techniques and criteria for determining the amount of suspended solids contained in industrial plant waste discharges.

Weapon System Readiness Through Logistics

Colonel James F. Mothersbaugh, USAF (Ret.)

The term "logistics" might be compared to "iceberg" as to implications. In both instances there is much more in existence than is readily apparent. What contribution can logistics make to a weapon system? When must logistics be considered to enjoy alleged benefits of weapon system readiness? What can be done to improve logistics? As a matter of fact, would you please define logistics? These are the more searching type questions received by practicing logisticians and those who have retreated to the second line of offense, that of teaching or crusading for logistics improvements.

Since World War II great strides have been made in technology advancement. Breakthroughs in scientific as well as fabrication processes have placed highly sophisticated and correspondingly complex weapon systems and countermeasures within the state of the art, and many within our inventory. Unfortunately, management schools of discipline, the methods, procedures and techniques necessary to acquire and logistically support these technological achievements have not enjoyed the same degree of progress. It must also be acknowledged that logistic support, not enjoying the glamour possessed by technology, has not received a comparable amount of top management attention, at least not with the enthusiasm and perfection of technology.

Many significant changes have occurred in the concept of weapon system acquisition, *i.e.*, the prototype test era (fly before you buy), the concurrency concept (buy before you fly), the four-step life cycle conditional descision procedure and, more recently, the total package procurement with its attendant Government-contractor "disengagement" policy, all of which have required significant reaction from logistic support functions in order to fulfill the in-service support mission. Many incremental, improvised, and sometime frantic stop-gap measures have been implemented by functional logistic support agencies to accommodate these radical new approaches to acquiring the best performing weapon system, at the most economic cost, within the time period it could be effective.

Logistic management personnel and top defense planners might well be criticized for not having devoted more research and development emphasis to the logistic planning and support function, to have ensured a comparable basis for logistic action rather than reaction, to accommodate these new acquisition concepts. If improvements in logistical capabilities are to keep abreast of acquisition and operational needs, it becomes necessary that top level management planners and decision makers, in other than the logistics field, know the functions and elements comprising logistics, and lend their support to the logistic cause during the analysis, review and decision-making process. This article will attempt to identify the functions involved in logistics, some of the significant elements worthy of intensified management attention within those functions and, hopefully, provide an appreciation of the need for and the scope of logistic involvement early and continuously in the weapon system acquisition process.

Colonel James F. Mothersbaugh, USAF (Ret.), is serving as a consultant to the Defense Weapon Systems Management Center, Wright-Patterson AFB, Ohio. His last two assignments prior to retirement from the Air Force were Deputy Director of Logistics for the B–70 and B–58 Programs, and Chief of the Logistics Department at the Defense Weapon Systems Management Center.

Definitions

Maybe a good place to start the discussion is in regard to some of those latent entities that lurk in the filmy shadows of the all embracing term, "logistics." Logistics could be defined as:

> **The planning and acquisition from initial concept for the services necessary on hardware and software to attain and sustain a specific support requirement or need.**

There are no formal institutions or Service schools that graduate a logistician, with qualification credentials entitling him to be placed in a position of management trust, for the planning and control of 60 to 70 percent of the dollars allocated to the operational support phase of a weapon system program. If that doesn't seem unusual, consider that his knowledge of logistics, its fundamental requirements, capabilities and constraints, will determine if the weapon system force structure obligations are met, all else being equal. The attainment and sustenance of the combat ready status specified in requirements documents are dependent upon his ability. Without adequate attention, logistics can well become the long pole in the weapon system tent that would dictate the combat readiness date of the system, if not its actual activation date.

While there may be many definitions of logistics, program/project management logistics is a composite of several functional disciplines familiar to most everyone associated with the Military Services and can be identified as: maintenance, supply, procurement, transportation, personnel, facilities and their attendant reporting and documentation methodologies. Under these functional disciplines will be further identifications of elements and tasks that collectively fulfill the complete logistic requirement of an individual weapon or support system, *e.g.*, provisioning of spare components and repair parts, source coding of reparable items and levels of repair authorized, common item support, technical orders, high-value item identification and control, ground support equipment, material improvements, packing, preservation, warehousing, inspection, servicing, skill requirements, training devices and curriculum, manning quantities, etc.

Within the functions, elements and tasks of the total logistic requirement and its progression from concept formulation to phase-out from the inventory, there are actions which can proceed in parallel, and those that must suffer the dependency of series progress subsequent to some particular action completion. Something common to all of these ultimate actions is their need for early planning considerations, and progressive refinement to further define more specifically logistics requirements as visibility improves further down the weapon system life cycle.

Let us review some of the more important logistics functions starting with the most vital one, maintenance. Our review will not be in comparison of cost, importance of precise planning and control to assure the composite product will make its appearance on a predetermined "need date," nor the degree of time, effort, energy, or brains necessary to attain that remarkable achievement. Rather, it will be from the point of view that maintenance is the fusion point of all those endeavors. A deficiency in any one of the contributory functions, elements, or tasks we will discuss, whether within the logistics realm or external to that function, will require maintenance to brace itself for the inevitable bow wave that is headed its way.

Maintenance

Assume, momentarily, that maintenance is the dependent function within logistics, that all other logistic functions, elements and tasks are dressed upon for time-on-target fusion of their action inputs. Then let us delay, temporarily, further discussion of other logistic items, in order to address ourselves to the time sequencing of the weapon system acquisition cycle that must first consider this maintenance function. Concept formulation is generally the earliest planning phase of concern to weapon system managers.

Concept formulation addresses itself to feasibility and cost-effectiveness studies of various approaches to fulfill a stated military requirement and, possibly, weapon and subsystem analysis studies, the ultimate objective of which is fundamentally two-fold: first, to select the best mix of system feasibility approaches in or within development capability; and, secondly, to provide a basis of conditional decision to establish a program baseline configuration in order to proceed into engineering or operational system development in the contract definition phase.

The extent of logistical elements input appropriate for feasibility consideration in this early life cycle phase is proportional to, and somewhat dependent upon, the state of the art, or the degree of development yet required on the basic weapon system. For example, a new cargo aircraft would include concept, feasibility, and specific itemized requirements in considerable detail on most logistic functions and elements, because previous similar systems could provide specification data for requirements, identification and analysis purposes. On the other hand, maintenance of a space rendezvous station would require extensive development action, spawning a multitude of logistic problems not previously encountered and for which no, or possibly only limited, test simulation experience data was available. Under the latter condition, the minimum logistical ingredient essential would be a maintenance concept, upon which ultimately could be constructed the other functions and elements of logistics requirements. As progress continues down the life cycle, succeeding actions in logistics can and must become more specific and detailed.

The development and production baselines are the flood gates in the weapon system life cycle that unfold a multitude of complex and intermeshed logistic actions. The maintenance concept established in the concept formulation phase must identify whether conventional methods of maintenance will be employed, or if development of a new capability is required. Specific requirements must be stated such as:

- Turn-around time for relaunch of the weapon system, and/or the readiness rates expected. This could measure the supportability and maintainability characteristics of the end article.
- Utilization rates projected could quantify the minimum use levels, with factors to consider for increased utilization which would allow tactical flexibility and growth for new targeting and mission requirements.
- Fall-out rate of the end items could be used to measure the effect of use on readiness and reliability attainment.
- "Manhours per flying or readiness hour" being a measurement of operational costs of maintenance at a specified use or rate level, at a given mean-time-to-repair (MTTR) and mean-time-between-failure (M-TBF).

The foregoing requirements are the most significant considerations for total logistic weapon system measurement. Some other subordinate factors for cost-effectiveness and trade-off consideration are:

- Maintainability expressed in maintenance manhours per flying or readiness hour for subsystems and select components.
- Mean-time-to-repair of the subsystems and select components and accessibility thereto within the weapon system itself.

- Reliability stipulations expressed in mean-time-between failure of the subsystems and their major components.
- Maintenance personnel basic knowledge prerequisites prior to specialized training.
- Specialized training necessary and quantity of personnel to receive that training.
- Minimum training devices essential to the transfer of skill knowledge necessary to attain and sustain maintainability requirements to be designed into the weapon system.

If cost, schedules and operational effectiveness are to be more fully exploited, the establishment of early fundamental logistic cornerstones, such as the maintenance concept, should have the inputs of the "in-Service" maintenance engineer, as distinguished from the development design engineer. Normally it is the in-Service engineer who is responsible for weapon system readiness, once it has been fielded. Whether by design or default, the weapon system in-Service support agencies are not, at this writing, importing the knowledge and influence of their composite potential to the critical concept formulation analysis and decision-making phase. Attempts to exert this influence on design at the headstream source, by persuasion rather than authority, is thwarted by insufficient upper management attention or understanding of the downstream implications. In the frenzy or under the pressures to get development, design, and hardware in being, subsequent support problems predicted three to four years hence have traditionally not been considered too pressing by upper echelons of decision-making management. For instance commercial industry has only recently (last eight to 10 years) begun to recognize logistics in early planning rather than an after-the-sale, design configuration necessity.

A most effective method of insuring logistic support to a weapon system is by insisting upon logistics involvement in early planning actions, and by the organizational placement of logistic managers on a comparable level with other program/project manager office staff agencies. Without this stature, responsibility and voice, many elements of logistics will be delegated "out of sight" several tiers down the organizational chain and fragmented under other staff agencies.

The contract definition effort for the logistic function of maintenance requires expansion, both qualitatively and quantitatively, in the Request For Proposal (RFP) to identify and specify maintenance elements and tasks as to who, when and under what condition required actions are to be accomplished. Response to these RFP requirements should be in a form of validation and verification, through computer simulation, to further substantiate credence of previous feasibility studies and the contractors proposals to the RFP. The critical, repairable and high value items of spares, ground support equipment and training devices must be included in this effort, with computer simulation programing projected through at least 10 years of operational need for cost and logistical estimation purposes, and preferably for the planned life expectancy of the weapon system.

Supply Function

Let us now identify another significant logistic function critical to ultimate weapon system readiness, supply. Simply put, supply is providing hardware, software and services in a usable condition upon demand! However, there is a long and tortuous route from head source to the happy event just defined. It starts in the concept formulation phase with the maintenance concept where a determination must be made: Can this weapon system be maintained in a conventional manner, like the cargo aircraft referred to earlier, or is further development action required? Development action concurrent with the end item must correct this maintenance support deficiency. Progression into the contract definition phase provides the baseline for specific identification of what maintenance tasks will be done, where, and by whom. The overall reliability of the weapon system, its subsystems and components must then be addressed to that requirement. Maintainability to those reliability requirements must consider and provide for the tools, ground support and test equipment, spare components, repair parts, facilities, transportation, preservation, packaging, storage, issue, etc.

The supply concept and, subsequently, the more detailed supply support plan must be documented in the early part of the weapon system life cycle. Immediately upon contract award, the item commodity managers execute the supply support plan, and commence provisioning actions that will directly result in hardware procurement for initial and follow-on support purposes. These actions include identification and then selection of all potential spare components and repair parts, their classification as to high value, critical, repairable, etc., the quantity per line item for initial full-range coverage, and then determination of the need date and approximate costs associated with the approved lists.

While item/commodity managers are obligated to do this on every weapon system using their item, they are also responsible for considering current stocks on hand and correlating reprocurement actions for each new weapon system requirement with their world-wide inventory needs, plus using the production spares and installation component residue. The supply provisioning action is vital to the ultimate maintenance capability in support of the combat ready status of the weapon system. Not only is this true in or during its initial activation, but also in sustaining that combat ready status through depth of extended support.

Intimately related to supply is the function of reprocurement. The initial range of spares are provisioned to support the operational systems for one to two years. The reprocurement actions, necessary to sustain levels of stocks projected to support system readiness, will routinely fall upon the item/commodity managers of the Services or other DOD support agencies.

Initial identification and purchase of reprocurement data is a must, if lead times to reprocure are to be held to a minimum, and inventories are to enjoy configuration stability. Further, advantages of competitive contract reprocurement cannot be fully exploited without such data. Commonly, the development agencies of the Military Departments are responsible for weapon system and initial provisioning procurement. Subsequently, however, reprocurement of support items are the item/commodity managers' responsibility. The time period in which they pick up that responsibility varies within the Departments. While planning for the reprocurement activity should be considered early in the weapon system life cycle, normally the action does not physically take place until well into the acquisition phase. Predominantly, reprocurement actions are taken subsequent to testing and after the beginning of the operational phase. Long lead time items are exceptions to this policy. Initial test support table lists are purified and, hopefully, testing progression has begun to stabilize configuration and qualify subsystems and components.

Personnel Considerations

Another important link in the logistic chain is the personnel requirements. From the logistical point of view it must include the human, machine, environment relationships in determining total requirements. All too often, the training devices necessary to prepare the operators and maintenance personnel for military weapon systems have not been timely, have not been configured like the ultimate end item, and have not done the job of training those initial crews prior to tactical performance.

With the advent of modern technology, weapon systems have become highly complex. Determination must be made concerning what basic educational qualifications are necessary, the skill level requirement to perform various levels of maintenance support tasks, the quantities of those skills and personnel needed, curriculum courses to achieve that knowledge level, and the training devices necessary to transfer and demonstrate that performance level knowledge. The lead times involved in review and analysis to achieve that capability have many dependent variables fraught with delay hazards. Objective milestoning, with unrelenting management attention for progress, is the only method of achieving an adequate training posture by the weapon system need date, which is normally 90 to 120 days prior to tactical activation date.

Transportation Facilities

Transportation and facility requirements are two functional categories of logistic ingredients vital to weapon system readiness and operational flexibility. Both of these weapon system support prerequisites involve long lead time budget planning, and are dependent upon the maintenance, supply and operational concepts.

These two functions have traditionally responded to the need so consistently that there is a tendency to "take for granted" their support, without deliberately defining and projecting qualitative and quantitative requirements in these functional areas. Premium transportation to and from a central repair site, or issue from a central storage site, might well be offset cost-wise by the reduction of high value components required for a disbursed inventory, while enjoying an improved availability effectiveness as well. Correspondingly, mobile support teams might satisfy an operational deployment mobility requirement, while simultaneously fulfilling a facility requirement as well. As an example, jet engine test cells were initially a semi-permanent facility as were aircraft weighing scales. Both are now highly portable and mobile. Early planning and definition of requirements will allow these two vital functions to act, rather than react to a weapon systems need.

Technical Data

Throughout the functions, elements and tasks involving logistics flows the life blood of a sustained support capability, technical data. This includes technical orders, drawings, aperture cards, microfilms, reliability and maintainability factors, deficiency reporting, and all other data required to operate and maintain the weapon system and its support equipment at a high operational readiness state. Fund estimating techniques are at best vague, in the early concept formulation feasibility study time period for this vital ingredient. However, during contract definition, qualitative and quantitative requirements can be defined and stated in the RPF. The requirements should identify specific type and format of data desired, as there are excessive costs involved in certain types of format, even though all are acceptable under DOD policy guidance, depending on the specific need.

Contractor Support

A final function, not to be forgotten, is contractor support. The concept formulation studies should identify to what extent contractor support is to be required. All Military Departments employ such support to at least a limited degree. Some weapon systems elect to use it extensively, and for an extended period of time down the operational life cycle until design stability and organic capabilities are achieved. Regardless of the planned use, such facts are identifiable early and should materialize as specific requirements upon which costs and workbreakout tasks can be associated for proposal response.

Applying the Plan

The logistic support plan is initially executed within approximately 10 to 45 days after contract signature. Provisioning actions get under way, and procurement of initial support and follow-on reprocurement support commitment obligations are formulated. Test support tables are exercised and progressively refined to purify follow-on reprocurement, as configuration of the weapon system stabilizes. Many factors, outside of the logistic sphere, influence attaining and sustaining that fully equipped, combat ready weapon system status envisioned by all.

Let us look at a couple of the more influential factors; first, changes. Formal change control discipline does not really come to bear until the production baseline configuration has been established, and the requirements of ANA Bulletin 445 apply. Once this point has been reached in the acquisition cycle, logisticians must consider and commit their activities to each change considering the impact involved in funds, materiel, schedule, and their ability to support the influencing requirement generating the change. These changes can be far-reaching, *e.g.*, the plan for a strategic, high-altitude bomber, for tactical reasons, being changed to a low-level, all-weather strike capability; the straight deck aircraft carrier, whose capability to support combat operations was enhanced by addition of the canted deck; the artillery piece and its awesome capability improvement through adaptability to the use of atomic munitions.

In each case cited, the changes had something in common. Each was monumental in its impact on the logistics functions of maintenance, supply, personnel, transportation, facilities and technical data, as well as the elements and tasks subordinate to those functions. Extensive provisioning reviews were necessary. Personnel training, skills, numbers of personnel, human factors and training devices were involved. New tools, testing, and repair procedures required changed original needs, and probably rendered most of those original needs either obsolete or subject to retrofit modifications. It is difficult for one, who has an appreciation of the logistic tasks involved, to envision how timely and adequate support came to pass in the actual examples referenced. This is because logistics is not yet a science.

A second influential factor is materiel deficiency reporting which generates inservice modification changes. It generates data for analysis considering systems and components that are high maintenance manhour consumers, and those causing excessive weapon system down time, increased overhaul requirements with related spares consumption, mission aborts, etc. This type of a reporting system is employed by all of the Military Departments. It provides the media for improved reliability and overall product improvement needed in support of weapon systems, by reuse of the reliable subsystems and components in future weapon systems, where practical, and non-use or redesign of the unreliable items.

Logistics Support

From a logistic support view, herein lies a great potential yet untapped for improved and more effective support, at reduced costs across the board, in the logistic functions, elements and tasks. In-Service engineers, in coordination with design engineers, could, if properly motivated by upper echelons of management, achieve meaningful weapon system support improvements in initial design through analysis and application of this available data. Using a qualified item has its attendant savings in design costs, technical data, in-being repair capability, maintenance learning curve established, supply channels stabilized, training courses and personnel skill requirements determined, etc., not to mention a known proven reliability factor.

Concurrent with this effort is the need for in-Service engineering considerations during design for maintainability requirements concerning man-machine relationships, *e.g.*, composite grouping within a weapon system of munitions, hydraulic, electrical, pneumatic and other subsystem-related components, rather than space available placement. This would allow full, simultaneous maintenance personnel saturation for turn around or re-launch. Also of importance is the consideration for natural body movements and positions of the maintenance technicians during the act of accomplishing a maintenance task, *i.e.*, standing on the floor or deck rather than on a maintenance stand or reaching back into an inaccessible crevice. Use of standard tools rather than special tools is another important factor in reducing the quantity of inventory items required.

Thirdly, all of the Military Departments have a functional method of doing logistical business. Determination of respective requirements of those various logistic functions, their time-phasing requirements and shifting of charter responsibilities during weapon system life cycle progression is a highly intricate process. Currently, there is no one central staff agency within the project/program managers organization, which is responsible for correlating this massive, complex, costly and vital effort into a fused, time-on-target realization. This void in our management scheme to acquire weapon systems is directly opposed to the concept of management by exception, unless of course one wants to believe no problem exists in planning and acquiring logistic support of our weapon systems and related equipment. The diversified functions and fragmented organizations, charted to exercise control of logistics support to program/project management, has many built-in cracks into which delegated and redelegated logistic tasks can fall. The program/project management office needs a staff agency responsible to its director for all logistics requirements of his program/project. It would be responsible for blending the in-Service/development engineering design into the best performance/maintainability configuration trade-off, and for meshing all the logistic functions, elements and tasks into hardware, software and services on a pre-determined "need date" basis.

Significant byproduct benefits would be accrued by this management application:

- The principle of intensifying management where a significant monetary and effectiveness improvement potential exists for the effort and cost outlay to attain that improvement.
- A centralized control of logistic requirements and input to the total weapon system, rather than the fragmented, tunnelized achievement now being experienced.
- Professionalism would be released, the engineers for doing engineering and the logistician to apply his talents toward needs for which currently many design engineering hours are being consumed, trying to fulfill what is believed to be valid logistic requirements.
- Establish the baseline for initial functional inputs of all logistical agencies, serve as the cornerstone upon which to base the operational planning, and provide continuity subsequent to transitioning of the weapon system from program/project to functional type management.
- Provide the logistician with the stature, prestige and responsibility commensurate with his government,

military and commercial counterparts, a consideration which is long past overdue if cost, schedule and performance are to be the true objectives in program/project management.

Logistics, to be sure, will for a considerable time period remain an art rather than a science. However, further use of available management principles and disciplines could improve its effectiveness considerably, when they are applied against specifics such as the monetary, stature and responsibilities referenced previously. An all-out research effort is needed to identify additional logistic requirements reducible to factors that are computer digestible. Research efforts in the use of computers to serve logistics should be intensified; especially in cost estimation and early planning and requirements determination phase, because it is here the support costs might well decide which weapon system or which concept of support is acceptable within certain time and dollar constraints.

For years to come, much professional guessing will still be involved in estimating logistic requirements across the board. Some of these estimates will be good and some bad, with costs and schedules probably being the most nebulous. Regardless of what is done to improve the logistic posture, the job will get done in the future just as it has in the past, but the accomplishment story does not stop there. While we like to think we live in a mechanical computerized age of pushbutton capability, if we eliminate the human determination to get the job done regardless or in spite of conditions our electronic, automatic, scientific management bubbles would undoubtedly burst. That is not to say management planning, control and direction are not necessary but, hopefully, it is to identify to management at all levels that their decisions have far-reaching effects on the logistic envelope. They should demand exhaustive logistic inputs to all plans and deliberations, with detailed consideration of impacts to logistic and commitments as to acceptability of those impacts by a responsible designated logistician. If this is not done, the logistic requirement you don't foretell will surface downstream and cost like hell, in dollars, schedule and combat readiness of our weapon systems.

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ABOUT PEOPLE

(Continued from page 19)

ier, Commandant of the Fourteenth Naval Dist., and Commander, Pearl Harbor Naval Base.

RAdm. Eli T. Reich has been assigned as Asst. Dep. Chief of Naval Operations (Logistics).

RAdm. Stephen Sherwood has assumed command of the Naval Supply Center, San Diego, Calif. relieving **RAdm. Leland P. Kimball.**

Dr. Donald Ross has been appointed as Associate Technical Dir. and Head of the Acoustics and Vibration Laboratory, Naval Ship Research and Development Center, Washington, D.C.

Harvey L. Cupp has been named Superintendent of the Aircraft, Weapons, and Ship Div., Engineering Dep. (Ship Installations), Naval Air Engineering Center, Philadelphia, Pa.

The following captain assignments have been announced by the Bureau of Personnel:

Capt. Robert R. Crutchfield, Asst. Chief of Naval Personnel (Plans and Programs); **Capt. Jerome J. Scheela,** (SC), Commanding Officer, Naval Supply Center, Pearl Harbor, Hawaii; **Capt. Howard F. Curren** (CEC), Commanding Officer, Chesapeake Div., Naval Facilities Engineering Command, Washington D.C.; **Capt. Oscar F. Dreyer,** Commanding Officer, Missile Engineering Station, Port Hueneme, Calif.; **Capt. William M. Gustafson,** (CEC), Commanding Officer, Gulf Div., Naval Facilities Engineering Command, New Orleans, La.; **Capt. W. A. Hopkins,** Commanding Officer, Naval Air Engineering Center, Philadelphia, Pa.; **Capt. George D. Howard,** Commanding Officer, Naval Ordnance Missile Test Facility, White Sands Missile Range, N.M.; **Capt. Charles R. Lee,** Dir. of Supply, Naval Weapons Center, China Lake, Calif.; **Capt. Roland Rieve** (SC), Dep. Commander (Planning & Policy), Naval Supply Systems Command; and **Capt. Edward M. Sanders,** Asst. Commander (Research and Development), Naval Facilities Engineer Command Headquarters, Washington, D.C.

DEPARTMENT OF THE AIR FORCE

Norman S. Paul, Under Secretary of the Air Force, has announced his resignation to become effective Sept. 30, 1967. The President has nominated **Townsend Hoopes,** Principal Dep. Asst. Secretary of Defense (International Security Affairs), to be Mr. Paul's successor.

Maj. Gen. Don Coupland, has been assigned as Assistant to the Comptroller of the Air Force. **Brig. Gen. George E. Brown** relieves Gen. Coupland as Auditor General, in the Office of the Air Force Comptroller.

Maj. Gen. Donald W. Graham, has been assigned as Dir., Maintenance Engineering, Air Force Logistics Command Headquarters, Wright-Patterson AFB, Ohio.

The following assignments have been made in the Air Force Systems Command:

Brig. Gen. Harold C. Teubner, Dep. Chief of Staff, (Comptroller), Hq, AFSC, Andrews AFB, Md.; **Dr. Alan M. Lovelace,** Dir., Air Force Materials Laboratory, Wright-Patterson AFB, Ohio; **Col. Geoffrey Cheadle,** Director of Information, Hq, AFSC; **Col. M. A. Cristadoro,** Dep. for Engineering, Aeronautical Systems Div., Wright-Patterson AFB, Ohio; **Col. Robert W. Dickerson,** Dep. for Communications, Electronic Systems Div., L. G. Hanscom Field, Mass.; **Col. Robert A. Duffy,** Dep. for Re-Entry Systems, Space and Missile Systems Organization, Los Angeles, Calif.; **Col. Roy E. Guy,** Dep. Dir., Policy and Concepts Planning, Hq, AFSC; **Col. Robert D. Hippert,** System Program Dir., Advanced Manned Strategic Aircraft, Aeronautical Systems Div.; **Col. T. A. Redfield,** Track Director, Holloman AFB, N.M.; and **Col. Lee R. Standifer,** Director, Technology and Subsystems, Foreign Technology Div., Wright-Patterson AFB Ohio.

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Cameron Station
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Others may purchase these documents at the price indicated from:

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Method for Extension of Dielectric Constant and Loss Measurements of Liquids to 100MHz with a Fixed-Geometry Sample Holder. Harry Diamond Laboratories, Washington, D.C., for the Army, Nov. 1966, 30 p. Order No. AD–646 655. $3.

Determination of Carbon Black in High Gloss Enamels and Lacquers. Army Coating & Chemical Lab., Aberdeen Proving Ground, Md., Nov. 1966, 12 p. Order No. AD–646 381. $3.

Use of Thin-Layer Chromatography (TLC) for Identification of Aircraft Engine Oil Components. Naval Research Lab., Washington, D.C., Nov. 1966, 16 p. Order No. AD–646 699. $3.

Manual for the Use of the Universal Stage in Optical Crystallography. Naval Propellant Plant, Indian Head, Md., July 1966, 76 p. Order No. AD–801 791. $3.

Measurement of Gas Density by Electron Scattering. Arnold Engineering Development Center, Arnold Air Force Station, Tenn., Feb. 1967, 113 p. Order No. AD–646 590. $3.

Progress in Air Cushion Vehicles. David Taylor Model Basin, Washington, D.C., Oct. 1966, 60 p. Order No. AD–646 507. $3.

Development Design Methods for Predicting Hypersonic Aerodynamic Control Characteristics. Lockheed-California Co., Burbank, Calif., for the Air Force, Sept. 1966, 268 p. Order No. AD–644 251. $3.

Proceedings of Seminar on Theoretical Inviscid Fluid Mechanics. Naval Ordnance Lab., White Oak, Md., Sept. 1966, 122 p. Order No. AD–642 771. $3.

The Synthesis and Characterization of Spiro Polymers. Naval Ordnance Lab., White Oak, Md., Sept. 1966, 35 p. Order No. AD–641 873. $3.

Dry-Packed Beds for the Removal of Strong-Acid Gases from Recycled Atmospheres. Naval Research Lab., Washington, D.C., Aug. 1966, 13 p. Order No. AD–642 274. $3.

Ferrocene and Ferrocene Derivatives. Redstone Scientific Information Center, Redstone Arsenal, Huntsville, Ala., Sept. 1966, 425 p. Order No. AD–645 876. $3.

Eigtheenth Materials Review. Chemical Research and Development Labs., Edgewood Arsenal, Md., Dec. 1965, 76 p. Order No. AD–474 956. $3.

DEFENSE PROCUREMENT CIRCULARS

Distribution is made automatically by the U.S. Government Printing Office to subscribers of the Armed Service Procurement Regulation.

Defense Procurement Circular No. 54, June 26, 1967. (1) Establishment of CWAS Coordinating Group. (2) Material Inspection and Receiving Report Clause. (3) Procurement Management Reporting System, Section XXI, Parts 1 and 2. (4) Organizational Conflicts of Interest. (5) Foreign Purchases, Duty and Customs, (6) Accident Prevention Clause—ASPR 7–602.42(a). (7) Property Administration.

GOVERNMENT PRINTING OFFICE PUBLICATIONS

These publications may be purchased at the prices indicated from: U.S. Government Printing Office, Washington, D.C. 20402.

U. S. Government Organization Manual, 1967–1968. Described the creation and authority, organization, and functions of the agencies in the legislative, judicial, and executive branches. Catolog No. GS 4.109:967. $2.

The Need for Professionalism in Resource/Cost Analysis

Major General Wendell E. Carter, USAF

Early in 1961 the Secretary of Defense recognized the need to manage the vast defense effort in terms of main program entities, *i.e.*, "output," associating each "output" with all of the resource "inputs," regardless of Congressional appropriations used to fund these resources. Such an association of total resource requirements, with a given program under consideration, permits the performance of cost-effectiveness analysis (or cost-benefit or resource analysis) which, in turn, sharpens the judgment of and aids the decision maker. These considerations, among others, pointed to the need of bridging the established planning function, performed in terms of "output," with the budget function performed in terms of "inputs."

The application of resource analysis has been broadened to go far beyond the military. The President's memorandum to the Cabinet in August 1965 and the implementing Bureau of the Budget Bulletin 66–3 established, throughout the Executive Branch of the Government, a Planning-programming-budgeting system incorporating the most modern management techniques now used in Government and industry.

The application of resource analysis is not limited to government departments. Indeed most large industrial concerns and the rapidly expanding research community have applied such techniques for many years to choose among risks, effectiveness and costs. Senator Hugh Scott (R.-Pa.) introduced a bill in the 89th Congress, and re-introduced it in the 90th Congress, proposing that the President appoint a national commission "to study and recommend the manner in which modern systems analysis and management techniques may be utilized to resolve national and community problems in the non-defense section."

In most of the extensive discussions of systems analysis as a technique for laying out the facts for the decision maker, there has been generally an implicit assumption that the "cost" side of cost/effectiveness analysis is easily produced, and that the major problem is measuring effectiveness satisfactorily. I agree with the latter point, but believe it is time to emphasize equally the problems of good cost or resource analysis. Good resource analysis depends on three factors: good methods, good data and good people.

With the advent of the computer the importance of good methods and good data received considerable attention. To date, however, relatively little has been said about increasing the quality of the most important of the three resources, namely, people.

This article addresses itself to this question of improving the quality among these personnel and in the profession as a whole.

It would seem apparent that there is a fundamental requirement for professionalism in all areas supporting decisions with such significant implications as our national security. As application of systems analysis techniques is extended throughout activities of the Federal Government, to many state and local governments, and to the private sector of the economy, it becomes obvious that there is an urgent and increasing need for professionalism among all who are performing cost analysis/cost effectiveness analysis as elements of systems analysis.

There are many definitions of professionalism. I will state the one that best expresses the thought I wish to leave. By professionalism I mean "a calling which requires specialized knowledge and often long and intensive preparation, including instruction in skills and methods as well as the scientific, historical, or scholarly principles underlying such skills and methods; commits its members to continued study and to a kind of work which has for its prime purpose the rendering of a special service; and maintains, by force of organization or concerted opinion, high standards of achievements and of conduct."

Specialized Knowledge

There would probably be little dispute about the requirement of a very high order of specialized knowledge to prepare an estimate of resources required to build a Manned Orbiting Laboratory, or a supersonic transport in an international competitive environment, regardless of where on the government-industry team the analyst may be sitting.

That a long and intensive preparation is necessary for an individual to qualify to make such an evaluation and analysis is not so immediately apparent. Yet these qualities are characteristics of effective performance in this area.

Practitioners, who are acknowledged as experts by their compatriots, all assert that good resource/cost analysts are made not born. They learn largely by doing.

Continued Study

Nothing is more apparent than the need for continued study because we have an exploding requirement, both qualitative and quantitative, for skilled practitioners.

As to whether these practitioners render a special service, I think it is clear that, in the defense environment alone, the preparation of proper cost estimates and effective analysis of cost data, as a part of the total analysis, is of definite importance to the entire country. This is true if we consider that proper choice of major weapons, proper choice of contractors to develop and produce them, proper choice of force size and composition of forces, not to mention the billions of dollars involved each year, are fundamental to the security of the country.

One, then, must note the spreading of this analytical technique to all Federal governmental activities and to many state and local communities, and to such major problem areas as urbanization, transportation, education, and the Great Society objectives. It, then, seems clear that the function of providing adequate cost estimates and appropriate analysis of such data is going to be of greater and greater importance to everyone in the United States.

Standards of Achievement and Conduct

There is a tremendous growth in the requirement for skilled resource/cost analysis personnel in both the Government and industry. In spite of the obvious need for standards which identify the skills needed by a qualified person, there are no such standards within the Civil Service. Neither are there special job titles against which individuals can be recruited, particularly those from outside the Government.

Partly as a result of this, arguments ensue as to what qualities are required in prospective employees and what achievements represent those of good practitioners. There is no organization or concerted opinion to set standards of achievement or conduct.

The application of cost analysis to weapon system and force structure studies is young. This very youth would argue for an organization of professionals, with standards for acceptance, which would help achieve maturity and credence.

On the basis of foregoing, it would appear that rules are needed to establish who are the real experts in resource/cost analysis. Agreement is needed on basic techniques and approaches which are acceptable. A broad continuing exchange of data and information on good techniques on a professional basis is necessary. In the long-term interest of improving the profession, there is a requirement for a method of committing the members of the cost analysis community to continued study and recognition of real authority. There is a need for an organization to "let in the good guys and keep out the bad guys" and something equivalent to a "white hat" for the good guys—to maintain by force of organization or concerted opinion high standards of achievement and conduct.

The growth of systems analysis as an effective tool in decision making may have its Achilles' heel in the lack of professionalism among resource/cost analysis practitioners. In cost-effectiveness decisions, an informed knowledge of resources required may, in many analyses, be the issue on which the decision turns, be that in Government or industry, in national defense or international relations, or in problems facing the Great Society objectives.

Major General Wendell E. Carter, USAF, is the newly appointed Deputy Assistant Secretary of Defense (Information) in the Office of the Assistant Secretary of Defense (Comptroller). At the time this article was written, he was Deputy Chief of Staff (Comptroller) of the Air Force Systems Command. In his new position, General Carter is responsible for the collection, analysis and reporting of resource management information for the Secretary of Defense.

I urge those who are fascinated by the techniques of systems analysis to take more interest in the validity of cost information which feeds analytical processes. I urge those who practice the art of cost analysis to professionalize this art as fast as possible. If this is the wave of the future in decision making, it must assure that the best ingredients are available to contribute to the best decisions.

TACFIRE Definition Phase Contracts Awarded

Three industrial teams have been awarded definition phase contracts in the Army's Tactical Fire Direction System (TACFIRE) program.

The three teams are headed by Burroughs Corp., Paoli, Pa.; Litton Industries, Van Nuys, Calif.; and IBM Corp., Gaithersburg, Md. The five-month study contracts are valued at $1 million to $1.5 million each.

TACFIRE is the lead system of the Army's overall tactical program to exploit the new technologies of data processing and subminiature electronics. This program, called Automatic Data Systems within the Field (ADSAF), is directed by General Roger M. Lilly, Commander of the Automatic Data Field Systems Command, Fort Belvoir, Va.

TACFIRE is a digital computer-based system which will be designed to enhance the supporting fires of the field artillery by full or partial automation of certain data-handling functions heretofore processed manually. Significantly increased response time and accuracy are design requirements.

TACFIRE is the first of three ADSAF systems to be developed, and its general purpose hardware will be the basis for equipping other tactical data systems.

The Army Electronics Command, Fort Monmouth, N.J., is furnishing procurement and technical support to the TACFIRE Project Manager.

DEFENSE PROCUREMENT

Contracts of $1,000,000 and over awarded during the month of July 1967.

DEFENSE SUPPLY AGENCY

3—The Defense Personnel Support Center, Philadelphia, Pa., has awarded the following contracts for combat boots:

Endicott Johnson Corp., Endicott, N.Y. $2,032,126. 268,800 pairs.
H. H. Brown Shoe Co., Worcester, Mass. $2,009,276. 262,732 pairs.
Addison Shoe Corp., Wynne, Ark. $3,346,498. 450,000 pairs.
Genesco, Inc., Nashville, Tenn. $1,795,199. 240,000 pairs.
International Shoe Co., St. Louis, Mo. $1,538,000. 200,000 pairs.
Sportwelt Shoe Co., Nashua, N.H. $5,745,853. 800,000 pairs.

—The Defense Personnel Support Center, Philadelphia, Pa., has awarded the following contracts for wind-resistant poplin cloth:

Burlington Industries, Cramerton, N.C. $1,893,750. 2,500,000 linear yards.
Prestex, Inc., New York, N.Y. $1,712,125. 2,225,000 linear yards.
B. G. Colton & Co., New York, N.Y. $3,108,000. 4,000,000 linear yards.

—**Hunter Outdoor Products**, Long Island City, N.Y. $1,840,448. 253,132 mountain sleeping bags. Defense Personnel Support Center, Philadelphia, Pa.

5—**Hyster Co.**, Portland, Ore. $1,876,392. 189 fork lift trucks. Defense General Supply Center, Richmond, Va.

—**Outboard Marine Corp.**, Waukegan, Ill. $1,586,376. 1,200 centrifugal pumps. Defense Construction Supply Center, Columbus, Ohio.

6—The Defense Personnel Support Center, Philadelphia, Pa., has awarded the following contracts for men's polyester/wool coats:

Franklin Clothes, Woodbine, N.J. $2,327,500. 100,000 coats.
Marcie Dale, Inc., Atlantic City, N.J. $2,261,038. 112,770 coats.
Merit Clothing Co., Mayfield, Ky. $3,242,200. 130,000.
Albert Turner & Co., New York, N.Y. $1,262,800. 55,000 coats.

—**West Point Pepperell, Inc.**, New York, N.Y. $1,400,750. 1,300,000 yards of cotton duck cloth. Defense Personnel Support Center, Philadelphia, Pa.

—**International Textile Products**, LaFollette, Tenn. $1,385,743. 14,612 tent liners. Defense Personnel Support Center, Philadelphia, Pa.

—**Valley Metallurgical Processing Co.**, Essex, Conn. $1,346,354. 4,131,000 lbs. of aluminum powder. Defense General Supply Center, Richmond, Va.

—**Aluminum Co. of America**, Pittsburgh, Pa. $3,272,062. 10,011,400 lbs. of aluminum powder. Defense General Supply Center, Richmond, Va.

12—**W & S Garment Mfg. Co.**, Chicago, Ill. $2,268,625. 861,920 cotton mattress covers. Defense Personnel Support Center, Philadelphia, Pa.

13—**J. P. Stevens & Co.**, New York, N.Y. $1,808,859. 599,000 linear yards of tropical wool cloth. Defense Personnel Support Center, Philadelphia, Pa.

17—**Camel Mfg. Co.**, Knoxville, Tenn. $1,258,839. 5,719 kitchen tents. Defense Personnel Support Center, Philadelphia, Pa.

CONTRACT LEGEND

Contract information is listed in the following sequence: Date—Company—Value—Material or Work to be Performed—Location Work Performed (If different than company location)—Contracting Agency.

—**Mobil Oil Corp.**, New York, N.Y. $1,019,000. 200,000 barrels of grade DF–A Arctic diesel fuel. Defense Fuel Supply Center, Alexandria, Va.

24—**Phipps Product Corp.**, Boston, Mass. $1,414,542. Various quantities of petro-chemicals. Defense Fuel Supply Center, Alexandria, Va.

—**Burlington Industries**, New York, N.Y. $3,703,590. 957,000 linear yards of wool serge cloth. Defense Personnel Support Center, Philadelphia, Pa.

25—**Firestone Tire & Rubber Co.**, Akron, Ohio. $3,099,444. 760,251 liners for steel helmets. Defense Personnel Support Center, Philadelphia, Pa.

28—**S. I. Handling Systems, Inc.**, Easton, Pa. $2,410,850. A mechanized materials handling system for the Defense Depot, Memphis, Tenn. Defense Construction Supply Center. Columbus, Ohio.

—Lane Myers Co., Protection, Kan. $1,235,675. 153,500 coils of concertina barbed wire. Defense Construction Supply Center, Columbus, Ohio.

ARMY

3—**Federal Cartridge Corp.**, Minneapolis, Minn. $25,753,440. Production of various small arms ammunition. New Brighton, Minn. Ammunition Procurement & Supply Agency, Joliet, Ill.

—**Harvey Aluminum Sales**, Torrance, Calif. $7,628,915. Loading, assembling and packing medium caliber ammunition. Milan, Tenn. Ammunition Procurement & Supply Agency, Joliet, Ill.

—**Savin Bros., Inc.**, Bloomfield, Conn. $3,733,162. Construction of Black Rock Dam and appurtenant structures. Near Watertown and Thomaston, Conn. Engineer Dist., Waltham, Mass.

—**Capital Radio Engineering Institute**, Washington, D.C. $1,500,000. Classified services. Electronics Command, Fort Monmouth, N.J.

6—**Ryan Aeronautical Co.**, San Diego, Calif. $1,185,861. Engineering flight services for the MQM-34D target guided missile. McGregor Range, N.M.; San Diego; Okinawa; Taiwan and Panama. Army Missile Command, Huntsville, Ala.

7—**Gibraltar Mfg. Co.**, Port Huron, Mich. $1,537,315. Sprocket tank drives for M48 and M60 tanks. Tank Automotive Command, Warren, Mich.

—**Rulon Co.**, Aurora, Ill. $1,384,075. Plunger body assemblies and firing pins assemblies for M48 fuzes. Chicago, Ill. Ammunition Procurement & Supply Agency, Joliet, Ill.

10—**Mansfield Tire & Rubber Co.**, Mansfield, Ohio. $1,072,362. Tires for ¼-ton trucks. Tank Automotive Command, Warren, Mich.

11—**International Telephone & Telegraph Corp.**, Nutley, N.J. $13,570,353. $1,909,221. Radio sets and tactical antenna systems. Clifton, N.J. Electronics Command, Philadelphia, Pa.

—**H. L. Coble Construction Co.**, Montgomery, Ala. $4,612,396. Construction of 300 family housing units at Fort Benning, Ga. Engineer Dist., Savannah, Ga.

12—**Go Corp.**, Adrian, Mich. $1,077,785. Track assemblies for M113 armored personnel carriers. Tank Automotive Command, Warren, Mich.

—**Security Construction Co.**, Richmond, Va. $5,248,000. Construction of 340 family housing units at Fort Meade, Md. Engineer Dist., Baltimore, Md.

13—**C. D. Murray Co.**, Syracuse, N.Y. $1,553,850. Construction work on the Cayuga Inlet Local Flood Protection Project. Ithaca, N.Y. Engineer Dist., Buffalo, N.Y.

—**Hansel Phelps Construction Co. and Penner Construction**, Greeley, Colo. $2,049,000. Construction of a dining hall at the Air Force Academy, Colorado Springs, Colo. Engineer Dist., Omaha, Neb.

—**McDonnell Co.**, St. Louis, Mo. $2,500,000. Engineering development and test of an anti-personnel companion round for the Dragon weapon system. Titusville, Fla. Army Missile Command, Huntsville, Ala.

14—**Blount Bros.**, Montgomery, Ala. $26,443,000. Work on the Hannibal Lock and Dam Project. Hannibal, Ohio and New Martinsville, W. Va. Engineer Dist., Pittsburgh, Pa.

—**C. W. C. Associates**, Uniondale, N.Y. $3,472,694. Rehabilitation of the Combat Specialities Training Personnel Center, Fort Dix, N.J. Engineer Dist., New York, N.Y.

—**Prestolite Co.**, Toledo, Ohio. $1,202,132. 12-volt storage batteries. Oklahoma City, Okla., Vincennes, Ind., and East Point, Ga. Tank Automotive Command, Warren, Mich.

17—**Atlas Chemical Co.**, Wilmington, Del. $1,034,852. TNT. Chattanooga, Tenn. Ammunition Procurement & Supply Agency, Joliet, Ill.

—**Bell Helicopter Co.**, Fort Worth, Tex. $31,410,889. UH-1 helicopter rotary wing blades. Aviation Materiel Command, St. Louis, Mo.

18—**Bizzack Bros., and Juett Construction Co.**, Frankfort, Ky. $1,733,956. Relocation of 4.8 miles of Kentucky Highway Number 76 including the construction of a 274-foot bridge for the Green River Reservoir. Near Campbellsville, Ky. Engineer Dist., Louisville, Ky.

—**Newport News Shipbuilding & Drydock Co.**, Newport News, Va. $2,984,230. Design, manufacture and delivery of four hydraulic turbines for the Jones Bluff and Dam, Ala. Newport News, Va. and Benton, Ala. Engineer Dist., Mobile, Ala.

20—**Goodyear Tire & Rubber Co.**, Akron, Ohio. $4,161,065. Pneumatic tires. Gadsden, Ala. Tank Automotive Command, Warren, Mich.

—**R. E. Dailey & Co.**, Detroit, Mich. $2,548,628. Construction of outlet works and appurtenances at Paint Creek Reservoir, Ohio. Engineer Dist., Huntington, W. Va.

21—**R. G. LeTourneau, Inc.**, Longview, Tex. $4,807,600. Metal parts for 750-lb. bombs. Ammunition Procurement & Supply Agency, Joliet, Ill.

—**American Machine & Foundry Co.**, Brooklyn, N.Y. $4,345,085. Metal parts for 750-lb. bombs. Garden City, N.Y. Ammunition Procurement & Supply Agency, Joliet, Ill.

—**Bell & Howell Co.**, Chicago, Ill. $1,422,900. Time fuze metal parts for 60mm projectiles. Ammunition Procurement & Supply Agency, Joliet, Ill.

—**General Motors**, Cleveland, Ohio. $28,725,157. Armored reconnaissance/airborne assault vehicles. Army Weapons Command, Rock Island, Ill.

—**Western Contracting Corp.**, Sioux City, Iowa. $2,294,450. Stage II construction of Kaysinger Bluff, Mo., Dam & Reservoir. Engineer Dist., Kansas City, Mo.

—**United Aircraft**, Stratford, Conn. $2,923,844. Detachable pods for the CH-54A Flying Crane. Aviation Materiel Command, St. Louis, Mo.

24—**Hughes Tool Co.**, Culver City, Calif. $1,708,640. Rotary wing blades for light observation helicopters. Aviation Materiel Command, St. Louis, Mo.

—**General Construction Co.**, Portland, Ore. $1,016,000. Work on the Columbia and Lower Willamette Rivers Project. Engineer Dist., Portland, Ore.

25—**Harwell Construction Co.**, Orange, Va. $1,134,285. Construction work on the Buckhannon Flood Protection Project. Buckhannon, W. Va. Engineer Dist., Pittsburgh, Pa.

—**L. H. Terry Construction Co.**, Louisville, Ky. $1,955,098. Work on the Brookville Reservoir Project, Brookville, Ind. Engineer Dist., Lousville, Ky.

—**Page Airways**, Rochester, N.Y. $1,136,229. Services and materials, for a one year period, for the maintenance of military aircraft and supporting equipment of the Army Aviation Detachment at the Naval Air Station, Lakehurst, N.J. Aviation Materiel Command, St. Louis, Mo.

26—**Bulova Watch Co.**, Jackson Heights, N.Y. $1,359,721. Fuzes for 2.75-inch rockets. Ammunition Procurement & Supply Agency, Joliet, Ill.

—**Great Lakes Dredge & Dock Co.,** Cleveland, Ohio. $1,186,000. Work on the Buffalo, N.Y., Harbor Project. Engineer Dist., Buffalo, N.Y.

—**Frix & Foster Construction Co.,** Muskogee, Okla. $1,221,318. Work on the Robert S. Kerr Lock & Dam Project. Near Keota, Okla. Engineer Dist., Tulsa, Okla.

—**Remington Arms Co.,** Bridgeport, Conn. $2,468,960. 7.62mm cartridge tracers. $1,019,096. 5.56mm ball cartridges in 10-round clips. Frankford Arsenal, Philadelphia, Pa.

—**Olin Mathieson Chemical Corp.,** East Alton, Ill. $2,135,900. 7.62mm cartridge tracers. Frankford Arsenal, Philadelphia, Pa.

—**Olin Mathieson Chemical Corp.,** New Haven, Conn. $3,405,132. 7.62mm clipped cartridges. Frankford Arsenal, Philadelphia, Pa.

27—**Johnson Bros. Highway & Heavy Constructors and D. H. Blattner & Sons,** Litchfield, Minn. $1,034,792. Excavation of a cut-off trench at Chatfield Dam and Reservoir, near Denver, Colo. Engineer Dist., Omaha, Neb.

—**Raytheon Co.,** Andover, Mass. $1,220,000. Rebuild stabilized magnetron assemblies for the Hawk missile system. Army Missile Command, Huntsville, Ala.

28—**Baifield Industries,** Carrollton, Tex. $2,681,280. 155mm cartridges cases. Shreveport, La. Ammunition Procuement & Supply Agency, Joliet, Ill.

—**Kaiser Jeep Corp.,** Toledo, Ohio. $23,134,615. 1¼-ton vehicles. General Purpose Vehicles Project Manager, Warren, Mich.

—**General Electric,** Syracuse, N.Y. $2,030,000. Radar sets. Pittsfield, Mass., and Syracuse. Electronics Command, Fort Monmouth, N.J.

—**Gregg, Gibson & Gregg,** Leesburg, Fla. $1,799,322. Construction work at the Cental and Southern Florida Flood Control Project. Orlando and Cocoa Beach, Fla. Engineer Dist., Jacksonville, Fla.

—**R. R. Dawson Bridge Co.,** Bloomfield, Ky. $1,240,612. Green River Reservoir Project. Campbellsville, Ky. Engineer Dist., Louisville, Ky.

31—**Honeywell, Inc.,** Tampa, Fla. $7,645,261. Multiplexer components for use in the Army Area Microwave Relay Communications System. Electronics Command, Fort Monmouth, N.J.

—**Frequency Engineering Laboratories,** Farmingdale, N.J. $2,841,900. Compact light relay sets for ground troops. Electronics Command, Philadelphia, Pa.

—**Polarad Electronics Corp.,** Long Island City, N.Y. $1,743,000. Signal generators. Electronics Command, Philadelphia, Pa.

—**Caterpiller Tractor Co.,** Peoria, Ill. $10,180,730. Diesel engine driven tractors. Mobility Equipment Command, Warren, Mich.

—**Machlett Laboratories, Inc.,** Stanford, Conn. $8,975,477. 25mm image intensifier assemblies. Electronics Command, Fort Monmouth, N.J.

—**A. O. Smith Corp.,** Chicago, Ill. $6,843,406. Metal parts for 750-lb. bombs. Waco, Tex. Ammunition Procurement & Supply Agency, Joliet, Ill.

—**Hanson Machinery Co.,** Tiffin, Ohio. $6,177,911. Five-ton cranes. Mobility Equipment Command, St. Louis, Mo.

—**Machlett Laboratories,** Stamford, Conn. $5,170,000. Miniscopes for the Night Vision Program. Electronics Command, Fort Monmouth, N.J.

—**Koehring Co.,** Newton, Iowa. $3,673,357. Ditching machines. Mobility Equipment Command, Warren, Mich.

—**Elliott Machine Works,** Phoenix, Ariz. $2,123,199. Trailer mounted lubricating and servicing units. Galion, Ohio and Phoenix. Mobility Equipment Command, Warren, Mich.

—**Southwest Truck Body Co.,** St. Louis, Mo. $2,104,321. Six-ton semi-trailers. West Plains, Mo. Tank Automotive Command, Warren, Mich.

—**AVCO Corp.,** Stratford, Conn. $1,823,999. First stage nozzles for T53 turbine engines. Aviation Materiel Command, St. Louis, Mo.

—**Firestone Tire & Rubber Co.,** Akron, Ohio. Pneumatic tires for earth movers. Des Moines, Iowa. Tank Automotive Command, Warren, Mich.

—**Craftsman Construction Co.,** Denver, Colo. $1,196,750. Construction of a supply and procurement training building at Lowry AFB, Calif. Engineer Dist., Omaha, Neb.

NAVY

3—**McDonnell-Douglas Corp.,** St. Louis, Mo. $123,349,800. Configuration changes in the F-4E aircraft. Naval Air Systems Command.

—**Lockheed Aircraft,** Burbank, Calif. $55,027,050. P3B aircraft. Naval Air Systems Command.

—**Sanders Associates,** Nashua, N.H. $7,539,480. Electronic equipment. Naval Air Systems Command.

—**Litton Systems,** Woodland Hills, Calif. $4,201,947. Inertial navigation systems. Naval Air Systems Command.

—**General Motors,** Indianapolis, Ind. $1,842,272. Modification of a complete gas generator test rig for theoretical maximum turbine inlet temperature. Naval Air Systems Command.

—**International Harvestor Co.,** Melrose Park, Ill. $1,436,055. Aircraft towing tractors. Naval Air Systems Command.

—**Raytheon Co.,** Lexington, Mass. $1,375,000. Sparrow III guided missiles. Lowell, Mass. Naval Air Systems Command.

—**Sanders Associates,** Nashua, N.H. $1,078,647. Work on a classified electronics program. Naval Air Systems Command.

—**Sanders Associates,** Nashua, N.H. $1,026,173. Investigation, test and evaluation of current and future destruct techniques and devices and related problems. Naval Air Systems Command.

—**National Steel & Shipbuilding Co.,** San Diego, Calif. $24,838,900. One combat store ship (AFS). Naval Ship Systems Command.

—**Teledyne, Inc.,** Burlington, N.J. $11,177,893. Radio transceivers, control units, reports and data. Naval Ship Systems Command.

—**I.B.M.,** Owego, N.Y. $6,033,361. Sonar equipment. Naval Ship Systems Command.

—**Straza Industries,** El Cajon, Calif. $1,879,560. Submarine mine detection sonar sets. Naval Ship Systems Command.

—**Sperry Piedmont Co.,** Charlottesville, Va. $1,920,797. Radar sets. Naval Ship Systems Command.

—**Hughes Aircraft,** Fullerton, Calif. $1,209,300. Beacon video processors, associated hardware and software for use with naval tactical data systems on ships. Naval Ship Systems Command.

—**Columbus Milpar & Mfg. Co.,** Columbus, Ohio. $6,474,780. Fin assemblies for the Mark 82, 500-lb. bomb. Navy Ships Parts Control Center, Mechanicsburg, Pa.

—**American Mfg. Co. of Tex.,** Fort Worth, Tex. $3,864,000. Mark 82, 500-lb. empty bomb bodies. Navy Ships Parts Control Center, Mechanicsburg, Pa.

—**Intercontinental Mfg. Co.,** Garland, Tex. $1,091,141. Mark 82, 500-lb. empty bomb bodies. Navy Ships Parts Control Center, Mechanics, Pa.

—**Barrus Construction Co.,** Kingston, N.C. $1,161,400. Construction of an aircraft parking apron at the Marine Corps Air Facility, Jacksonville, N.C. Atlantic Div., Naval Facilities Engineering Command, Norfolk, Va.

—**Dynelectron Corp.,** Washington, D.C. $1,999,288. Data processing and related work. Point Mugu, Calif. Navy Purchasing Office, Los Angeles, Calif.

—**Unitec Industries,** Timonium, Md. $5,669,095. A mobile electric power plant for servicing aircraft. Washington, D.C. Navy Purchasing Office, Washington, D.C.

—**Bendix Corp.,** Mishawaka, Ind. $3,173,000. Continued engineering and development in the conversion of the Talos Missile Telemetry System. Naval Ordnance Systems Command.

5—**Westinghouse Electric,** Baltimore, Md. $19,063,578. Airborne radar sets. Naval Air Systems Command.

—**Collins Radio Co.,** Cedar Rapids, Iowa. $6,667,185. Airborne communication, navigation, and identification systems. Naval Air Systems Command.

—**Bendix Corp.,** Baltimore, Md. $4,590,782. Airborne radio receiver transmitter sets and related equipment. Naval Air Systems Command.

—**Westinghouse Electric,** Baltimore, Md. $2,562,500. Radar sets for F-4D aircraft. Naval Air Systems Command.

—**Sundstrand Corp.,** Rockford, Ill. $2,055,370. Constant speed drives and frequency control boxes. Naval Air Systems Command.

—**Sanders Associates, Inc.,** Nashua, N.H. $1,364,000. Classified electronic equipment. Naval Air Systems Command.

—**North American Aviation,** Los Angeles, Calif. $1,126,592. Lease of three multiengine light jet aircraft and supporting material and services. Naval Air Systems Command.

—**Logicom, Inc.,** San Pedro, Calif. $3,560,923. Computer programming for the Fleet Computer Programing Center, San Diego, Calif. Navy Purchasing Office, Los Angeles, Calif.

—**Lockheed Electronics Co.,** Watchung, N.J. $1,050,000. Design, development and engineering for service use, mandatory improvements for gun fire control system Mark 86 and related equipment. Metuchen, N.J. Naval Ordnance Systems Command.

—**Lockheed Missiles & Space Co.,** Sunnyvale, Calif. $35,339,082. Tactical engineering services in support of the fleet ballistic missile weapon system. Special Projects Office.

—**Washington Military Systems,** Bethesda, Md. $3,549,832. Engineering and support services for fleet ballistic missile weapon system training installations. Special Projects Office.

—**Interstate Electronics Corp.,** Anaheim, Calif. $6,250,000. Phase Two development of Poseidon (C-3) Digital Test Instrumentation Subsystem. Special Projects Office.

6—**Collins Radio Co.,** Cedar Rapids, Iowa. $5,971,028. Communication, navigation, identification systems and related equipment. Naval Air Systems Command.

—**LTV Aerospace Corp.,** Dallas, Tex. $5,900,000. Improvement changes to extend the service life of RF-8A aircraft. Naval Air Systems Command.

—**McDonnell-Douglas,** St. Louis, Mo. $5,359,586. Bomb racks and related equipment. Torrance, Calif. Naval Air Systems Command.

—**Sparton Corp.,** Jackson, Mich. $2,885,873. Sonobuoys. Naval Air Systems Command.

—**Sanders Associates,** Nashua, N.H. $1,309,474. Evaluate, repair and modify electronic equipment. Naval Air Systems Command.

—**General Precision,** Little Falls, N.J. $1,161,750. Airborne navigation sets. Naval Air Systems Command.

—**Litton Systems,** Silver Spring, Md. $1,009,492. Electronic countermeasure equipment. College Park, Md. Naval Air Systems Command.

—**General Dynamics,** Pomona, Calif. $10,000,000. Production of Type I guidance control and ordnance sections for the Standard Missile. Naval Ordnance Systems Command.

—**Goodyear Aerospace Corp.,** Akron, Ohio. $8,996,273. Production of Subroc missiles and related equipment. Naval Ordnance Systems Command.

—**General Precision,** Glendale, Calif. $6,000,000. Production of ordnance alteration kits for various fire control systems and for MK 48 torpedoes. Naval Ordnance Systems Command.

—**General Precision,** Glendale, Calif. $2,294,000. Production of various fire control systems. Naval Ordnance Systems Command.

—**Clevite Corp.,** Cleveland, Ohio. $1,500,000. Research and development of the comb filter techniques now being developed for MK 48 torpedoes. Naval Ordnance Systems Command.

—**Electronics Communications,** Sarasota, Fla. $2,441,723. Radio equipment. Naval Ship Systems Command.

7—**Hughes Aircraft,** Culver City, Calif. $15,000,000. Incremental funding for the Phoenix missile system. Naval Air Systems Command.

—**Lockheed Aircraft,** Marietta, Ga. $6,847,500. Progressive maintenance on Navy aircraft. Naval Air Systems Command.

—**Hayes International Corp.,** Birmingham, Ala. $1,308,147. Progressive maintenance on Navy aircraft. Naval Air Systems Command.

—**Westinghouse Electric,** Baltimore, Md. $1,800,000. Incremental research and development funding for prototype models of special exercise sections for MK 48 torpedoes. Naval Ordnance Systems Command.

—**General Dynamics,** Pomona, Calif. $1,000,000. Materials, labor, services and equipment to remove and replace original roofing and to install automatic roof vents on buildings at the Naval Industrial Reserve Ordnance Plant, Pomona, Calif. Naval Ordnance Systems Command.

10—**General Electric**, Washington, D.C. $7,300,234. Phase two development of the Poseidon missile guidance system. Pittsfield, Mass. Special Projects Office.

—**Sperry Rand Corp.**, St. Paul, Minn. $1,758,217. Shipboard remote-operated switching system with associated data, documentation, training and spare parts. Naval Ship Systems Command.

—**Canadian Commercial Corp.**, Ottawa, Ontario, Canada. $1,286,148. Overhaul of Navy aircraft. Edmonton, Alberta, Canada. Naval Air Systems Command.

11—**United Aircraft**, East Hartford, Conn. $25,585,000. J52-P-8A engines. Naval Air Systems Command.

—**Sperry Rand Corp.**, Great Neck, N.Y. $10,258,000. A technical assistance program for fleet ballistic missile submarines. Naval Ship Systems Command.

—**General Dynamics**, Groton, Conn. $5,000,000. Materials and components of long lead time items required to support the conversion of nuclear powered fleet ballistic missile submarines to include a Poseidon missile capability. Naval Ship Systems Command.

—**Sperry Rand Corp.**, Univac Div., St. Paul, Minn. $4,372,575. Computers with peripheral equipment and engineering services for ships. Naval Ship Systems Command.

12—**Northwest Marine Iron Works**, Portland, Ore. $1,248,175. Regular overhaul of the landing ship, dock USS Gunston Hall (LSD-5). Supervisor of Shipbuilding, Thirteenth Naval Dist., Seattle, Wash.

13—**Westinghouse Electric**, West Mifflin, Pa. $11,356,606. Nuclear propulsion research and development. Naval Ship Systems Command.

—**Sperry Rand Corp.**, Syosset, N.Y. $2,190,000. Two navigational trainers for fleet ballistic missile weapon systems. Special Projects Office.

14—**General Electric**, Schenectady, N.Y. $22,188,372. Nuclear propulsion components. Naval Ship Systems Command.

—**Sperry Rand Corp.**, Syosset, N.Y. $4,001,444. Repair and modification of a quantity of fleet ballistic missile navigation subsystem components. Naval Ship Systems Command.

—**United Aircraft**, Stratford, Conn. $3,300,000. Long lead time effort and materials for HH-53C helicopters for the Air Force. Naval Air Systems Command.

—**Allied Mechanical Contractors**, Chula Vista, Calif. $1,089,827. Construction of a central boiler plant and replacement of steam distribution branch lines at the Long Beach, Calif., Naval Station. Southwest Div., Naval Facilities Engineering Command, San Diego, Calif.

—**General Dynamics**, Quincy, Mass. $5,400,000. Development and production proposals for general purpose amphibious assault ships (LHA). Naval Ship Systems Command.

—**Litton Industries**, Culver City, Calif. $6,400,000. Development and production proposals for general purpose amphibious assault ships (LHA). Naval Ship Systems Command.

—**Newport News Shipbuilding & Dry Dock Co.**, Newport News, Va. $8,200,000. Development and production proposals for general purpose amphibious assault ships (LHA). Naval Ship Systems Command.

17—**Norris Industries**, Los Angeles, Calif. $6,798,963. Steel cartridge cases. Navy Ships Parts Control Center, Mechanicsburg, Pa.

—**M.I.T.**, Cambridge, Mass. $4,861,800. Development of the Poseidon (C-3) missile guidance system. Special Projects Office.

—**General Precision**, Riverdale, Md. $3,295,032. Prototype of a P3B flight simulator. Naval Training Device Center, Orlando, Fla.

18—**Raytheon Co.**, Sudbury, Mass. $15,836,520. Development of the Poseidon (C-3) missile guidance system. Special Projects Office.

—**Sperry Rand Corp.**, Syosset, N.Y. $2,700,000. Technical assistance in support of the navigation subsystems on nuclear powered fleet ballistic missile submarines. Naval Ship Systems Command.

—**General Dynamics**, Pomona, Calif. $2,400,000. Ordnance alterations for Terrier and Tartar missiles. Naval Ordnance Systems Command.

—**Sperry Rand Corp.**, Long Island City, N.Y. $1,174,397. Production of MK 118 MOD 2 and MK 119 MOD 3 guided missile systems computers for Terrier and Tartar missiles. Naval Ordnance Systems Command.

19—**Grumman Aircraft Engineering Corp.**, Bethpage, N.Y. $3,465,000. Construction of an anechoic chamber at the Naval Weapons Industrial Reserve Plant, Calverton, N.Y. Naval Air Systems Command.

—**General Dynamics**, Pomona, Calif. $3,685,666. Continue research and development on the Standard ARM missile. Naval Air Systems Command.

21—**General Dynamics**, Quincy, Mass. $63,177,118. Construction of two replenishment oilers. Naval Ship Systems Command.

24—**Mike Bradford & Co.**, Miami, Fla. $2,000,000. Construction of a test facility at the Naval Ship Research & Development Center, Washington, D.C. Chesapeake Div., Naval Facilities Engineering Command, Washington, D.C.

—**Talley Industries**, Mesa, Ariz. $1,979,093. Bomb ejector racks. Naval Air Systems Command.

26—**Aerojet General**, Sacramento, Calif. $10,431,707. Production of MK 56 mines. Naval Ordnance Systems Command.

—**Sperry Rand Corp.**, Great Neck, N.Y. $4,000,000. Fire control systems for Terrier missiles. Naval Ordnance Systems Command.

—**Lockheed Aircraft**, Burbank, Calif. $2,440,500. Classified work. Naval Air Systems Command.

—**United Aircraft**, East Harford, Conn. $2,256,577. Modification kits used to support TF30-P-3 aircraft engines. Aviation Supply Office, Philadelphia, Pa.

—**Todd Shipyards**, San Pedro, Calif. $1,610,519. Regular overhaul of the attack transport USS Bexar (APA-237). Supervisor of Shipbuilding, Eleventh Naval Dist., Long Beach, Calif.

—**Riha Construction Co.**, La Mesa, Calif. $1,342,000. Construction of an outpatient clinic at the Naval Hospital, San Diego, Calif. Naval Facilities Engineering Command.

—**Kennedy Van Saun**, Danville, Pa. $1,115,808. MK 36 projectiles for 50 caliber guns. Navy Ships Parts Control Center, Mechanicsburg, Pa.

27—**North American Aviation**, Anaheim, Calif. $1,393,000. Operation and maintenance of Government-furnished Ships Inertial Navigation System equipment. Naval Ship Systems Command.

—**Kaiser Aluminum & Chemical Sales**, Halethorpe, Md. $5,958,445. AM2 aluminum airfield landing mats. Naval Air Engineering Center, Philadelphia, Pa.

28—**General Electric**, Washington, D.C. $35,403,000. Fire control and support equipment for Poseidon missiles. Pittsfield, Mass. Special Projects Office.

—**Wiley Mfg. Co.**, Port Deposit, Md. $2,798,500. Construction of two 100-ton floating cranes. Naval Facilities Engineering Command.

—**Peterson Builders**, Sturgeon Bay, Wis. $2,021,153. Construction of a wooden-hulled coastal minesweeper. Naval Ship Systems Command.

—**P.M.I. Corp.**, Rancho Cordova, Calif. $1,405,526. Modifications to heating systems at Naval Air Station, Lemoore, Calif. Naval Facilities Engineering Command.

—**Northwest Marine Iron Works**, Portland, Ore. $1,669,565. Modification of the advanced instrumentation ship USNS General Hoyt S. Vandenberg. Supervisor of Shipbuilding, Eighth Naval Dist., New Orleans, La.

28—**Logistic Services Corp.**, Palo Alto, Calif. $3,740,000. Relocation of communication facilities at the Naval Radio Station, Sugar Grove, W. Va. Chesapeake Div., Naval Facilities Engineering Command, Washington, D.C.

—**Texas Instruments**, Dallas, Tex. $2,053,650. Submarine data gathering equipment and applicable data. Naval Ship Systems Command.

AIR FORCE

5—**Aerospace Corp.**, El Segundo, Calif. $23,320,000. Scientific, engineering and technical services in support of space and ballistic missile programs. Space Systems Div., (AFSC), Los Angeles, Calif.

—**Vitro Corp. of America**, Eglin AFB, Fla. $10,195,179. Management and operation of the Eglin Test Ranges. Air Proving Ground Center, Eglin AFB, Fla.

—**Adventure Line Mfg. Co.**, Parsons, Kan. $2,450,000. Production of bomb components. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio.

—**Westinghouse Electric**, Baltimore, Md. $1,559,725. Production of teletype equipment. Electronic Systems Div., (AFSC), L. G. Hanscom Field, Mass.

—**General Electric**, Cincinnati, Ohio. $1,330,815. Production of spare parts for J-79 aircraft engines. Oklahoma City Air Materiel Area, (AFLC), Tinker AFB, Okla.

—**Sargent Fletcher Co.**, El Monte, Calif. $2,004,362. Production of external fuel tanks for F-5 aircraft. $1,022,785. Production of aircraft bomb and rocket racks. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio .

6—**Tumpane Co.**, Los Angeles, Calif. $3,410,204. Annual maintenance and operations services at Los Angeles Air Force Station. El Segundo, Calif. Headquarters, 6592nd Support Group, Los Angeles, Calif.

—**International Telephone & Telegraph Corp.**, Nutley, N.J. $1,767,946. Production of spare parts for LORAN navigational sets. Warner-Robins Air Materiel Area, (AFLC), Robins AFB, Ga.

—**Schoonmaker Co.**, Sausalito, Calif. $1,750,200. Production of electrical generator sets. Sacramento Air Materiel Area, (AFLC), McClellan AFB, Calif.

—**Boeing Co.**, Wichita, Kan. $1,073,880. Engineering support services for the B-52 fleet. Oklahoma City Air Materiel Area, (AFLC), Tinker AFB, Okla.

—**Collins Radio Co.**, Cedar Rapids, Iowa. $1,400,000. Production of airborne electronic direction finder equipment. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio.

—**Northrop Corp.**, Hawthorne, Calif. $26,501,773. Production of T-38 aircraft and related equipment. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio.

—**Aerojet General**, Downey, Calif. $3,330,229. Production of bombs and related equipment. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio.

—**General Electric**, West Lynn, Mass. $1,989,622. Gyroscope components for F-111 aircraft. Aernautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio.

—**AVCO Corp.**, Richmond, Ind. $2,600,000. Production of fuzes for aircraft ordnance. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio.

10—**General Dynamics**, Fort Worth, Tex. $1,935,000. Inspection and repair of B-58 aircraft. Waco, Tex. San Antonio Air Materiel Area, (AFLC), Kelly AFB, Tex.

—**Lockheed Aircraft**, Jamaica, N.Y. $1,553,108. Inspection and repair of C-121 aircraft. Sacramento Air Materiel Area, (AFLC), McClellan AFB, Calif.

12—**R.C.A.**, Camden, N.J. $12,957,245. Operation, maintenance and logistic support of the White Alice Communications System for FY 1968. Anchorage, Alaska. Sacramento Air Materiel Area, (AFLC), McClellan AFB, Calif.

—**General Electric**, Philadelphia, Pa. $17,620,000. Research and development on the Mark 12 re-entry system. Space and Missile Systems Organization, (AFSC), Los Angeles, Calif.

13—**R.C.A.**, Moorestown, N.J. $4,629,000. Depot level maintenance of instrumentation radars for FY 1968. Air Force Eastern Test Range, Patrick AFB, Fla.

—**General Electric**, Syracuse, N.Y. $9,054,000. Operation and maintenance of space-track facilities. Shemya, Alaska. Sacramento Air Materiel Area, (AFLC), McClellan AFB, Calif.

—**Oregon Technical Products**, Grants Pass, Ore. $1,340,857. Bomb ejector racks. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio.

—**R.C.A.**, Moorestown, N.J. $2,210,500. FY 1968 operation and maintenance of the Moorestown space track facility. Sacramento Air Materiel Area, (AFLC), McClellan AFB, Calif.

14—**Boeing Co.**, Renton, Wash. $1,444,560. Modification of EC-135 aircraft. Oklahoma City Air Materiel Area, (AFLC), Tinker AFB, Okla.

—**LTV Electrosystems**, Greenville, Tex. $2,394,933. Inspection and repair of T and TF-102 aircraft. Greenville, S.C. San Antonio Air Materiel Area, (AFLC), Kelly AFB, Tex.

17—**Hayes International Corp.**, Birmingham, Ala. $3,206,272. Inspection and repair of C-124 aircraft. Warner Robins Air

Materiel Area, (AFLC), Robins AFB, Ga.

—**Philco-Ford Corp.**, Philadelphia, Pa. $1,724,700. Production of communications equipment. Oklahoma City Air Materiel Area, (AFLC), Tinker AFB, Okla.

—**General Motors**, Indianapolis, Ind. $1,930,423. Production of T-56 engine components. Oklahoma City Air Materiel Area, (AFLC), Tinker AFB, Okla.

18—**Radiation, Inc.**, Melbourne, Fla. $3,791,595. Testing, engineering and production of an airborne/ground data relay system. Palm Bay, Fla. Electronic Systems Div., (AFSC), L. G. Hanscom Field, Mass.

19—**TRW, Inc.**, Los Angeles, Calif. $2,074,500. Research, development, fabrication and manufacture of launch and orbital equipment for the VELA satellite program launch vehicle. Space & Missile Systems Organization, (AFSC), Los Angeles, Calif.

—**Sylvania Electric Products**, Needham Heights, Mass. $3,936,984. Support of a ground electronics system. Space & Missile Systems Organization, (AFSC), Los Angeles, Calif.

—**International Aerospace Services**, Charleston, S.C. $1,052,123. Inspection and repair of C-124 aircraft. Warner Robins Air Materiel Area, (AFLC), Robins AFB, Ga.

20—**Honeywell, Inc.**, Hopkins, Minn. $7,000,000. Production of land mines and associated equipment. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio.

—**Perkin Elmer Corp.**, Norwalk, Conn. $2,000,000. Manufacture of laser reconnaissance sets. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio.

—**Garrett Mfg. Ltd.**, Rexdale, Ontario, Canada. $1,208,768. Production of pressure temperature tests sets used in support of various aircraft. San Antonio Air Materiel Area, (AFLC), Kelly AFB, Tex.

21—**Boeing Co.**, Seattle, Wash. $2,160,048. Design, fabrication, assembly, checkout and testing of Minuteman equipment. Space and Missile Systems Organization, (AFSC), Los Angeles, Calif.

24—**Hughes Aircraft**, Los Angeles, Calif. $4,727,456. Manufacture of electronic spare parts. El Segundo, Calif. Warner Robins Air Materiel Area (AFLC), Robins AFB, Ga.

25—**Lockheed Aircraft**, Sunnyvale, Calif. $1,500,000. Work on a satellite control facility. Space and Missile Systems Organization, (AFSC), Los Angeles, Calif.

—**Honeywell, Inc.**, Hopkins, Minn. $4,370,731. Production equipment for aircraft ordnance production. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio.

—**McDonnell-Douglas Corp.**, Tulsa, Okla. $1,187,400. Installation of modification kits in RB-66B aircraft. Warner Robins Air Materiel Area, (AFLC), Robins AFB, Ga.

26—**Burroughs Corp.**, Paoli, Pa. $1,440,400. Back-up Interceptor Control (BUIC) site activation and related services. Electronics Systems Div., (AFSC), L. G. Hanscom Field, Mass.

—**General Dynamics**, Fort Worth, Tex. $2,880,000. Manufacture of pylon assemblies for F-111 aircraft. Sacramento Air Materiel Area, (AFLC), McClellan AFB, Calif.

—**General Electric**, Evendale, Ohio. $4,323,996. Major facilities expansion in support of J-79 engine production. Aeronaltical Systems Div., (AFSC), Wright-Patterson AFB, Ohio.

—**McDonnell-Douglas Corp.**, St. Louis, Mo. $1,200,000. Re-entry vehicle feasibility flight test program. Space and Missile Systems Organization, (AFSC), Los Angeles, Calif.

—**Boeing Co.**, Seattle, Wash. $5,000,000. Installation of antenna systems. Rapid City, S.D. Space and Missile Systems Organization, (AFSC), Los Angeles, Calif.

27—**North American Aviation**, Anaheim, Calif. $18,666,441. Design and development of a post boost control system for the Minuteman missile. Space & Missile Systems Organization, (AFSC), Los Angeles, Calif.

—**Chicago Aerial Industries**, Barrington, Ill. $2,720,620. Production of camera systems and lens cones. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio.

—**Curtiss-Wright Corp.**, Wood-Ridge, N.J. $1,271,149. Production of aircraft engine components. San Antonio Air Materiel Area, (AFLC), Kelly AFB, Tex.

—**International Telephone & Telegraph Services**, Paramus, N.J. $1,245,000. Management, maintenance and operation of Air Force Plant 42 in Palmdale, Calif. Air Force Flight Test Center, Edwards AFB, Calif.

28—**Systems Development Corp.**, Santa Monica, Calif. $14,389,265. Computer program updating and preparation of system training programs. Sacramento Air Materiel Area, (AFLC), McClellan AFB, Calif.

—**Electronic Communications, Inc.**, St. Peterburg, Fla. $3,363,133. Manufacture of electronic equipment for installation on EC-135 aircraft. Warner-Robins Air Materiel Area, (AFLC), Robins AFB, Ga.

—**AVCO Corp.**, Wilmington, Mass. $1,598,000. Work on a ballistic re-entry vehicle program. Space and Missile Systems Organization. (AFSC), Los Angeles, Calif.

—**Aerodex, Inc.**, Miami, Fla. $1,438,699. Overhaul of R-4360 reciprocating aircraft engines. San Antonio Air Materiel Area, (AFLC), Kelly AFB, Tex.

31—**Philco-Ford Corp.**, Palo Alto, Calif. $1,500,000. Work on a ground to space communications system. Space and Missile Systems Organization, (AFSC), Los Angeles, Calif.

OFF-SHORE PROCUREMENT

The following contracts were awarded by the U.S. Procurement Center, Frankfurt, Germany, on June 30:

—**Federal Republic of Germany, Bundesamt fuer Wehrtechnik und Beschaffung**, Koblenz, Germany. $8,390,658. 20mm guns and accessories. Dusseldorf, Germany.

—**Federal Republic of Germany, Bundesamt fuer Wehrtechnik und Beschaffung**, Koblenz, Germany. $15,453,052. 20mm ammunition. Dusseldorf, Germany.

—**Ford-Werke AG**, Koeln, Germany. $1,099,764. Vehicles and equipment. Kent, Ohio.

—**Jugoexport**, Belgrade, Yugoslavia. $1,588, 383. Household furniture.

Three Navy Research Centers Established

The U.S. Navy created three new research centers July 1 in a move to improve application of technology to naval warfare problems.

The new centers, formed from existing centers and laboratories in California, are:

- Naval Command Control Communications Laboratory Center (NCCCLC), San Diego, created from the Navy Electronics Laboratory (less its Underseas Technology Directorate).
- Naval Underseas Warfare Center (NUWC), Pasadena, made up of Pasadena Annex of the China Lake Naval Ordnance Test Station and several of its auxiliary sites, and the Underseas Technology Directorate of the Navy Electronics Laboratory.
- Naval Weapons Center (NWC), China Lake, established from the Naval Ordnance Test Station, China Lake, and the Naval Ordnance Laboratory, Corona. The Corona portion is called the Naval Weapons Center Corona Laboratories.

Commander of the NCCCLC is Captain William R. Boehm. The NUWC commander is Captain Grady H. Lowe, who is also acting commander of the NWC.

NSIA Symposium Looks to the Future

"National Research and Development for the 1970s" will be the theme for the third biennial symposium, sponsored by the Research and Development Advisory Committee of the National Security Industrial Association (NSIA). The conference, to be held in Washington, D.C., Oct. 18–19, will feature high-level speakers from the research and development community of the Government, industry and the academic world.

There will be four sessions in the two-day meeting covering the following subjects:

- The widening objectives of research and development in the 1970s.
- Technology forecasting and research and development planning.
- Institutions of the future.
- Methodology for national research and development programs.

The social aspects of the meeting will include two luncheons and a banquet. The evening function will feature a prominent speaker.

For registration and additional information, the contact is:

Paul A. Newman
National Security Industrial Association
1030 15th St., NW
Washington, D.C. 20005
Phone: (202) 296-2266

Project ARISTOTLE

(*Continued from page 6*)

so imperative for understanding in an undertaking such as this.

I suspect that few of us expected, at the onset, the interest and activity which ARISTOTLE would create. Moreover, I feel that outside of this effort other groups are recognizing the impact which DOD training and education is having on the economy. The entire May issue of *Phi Delta Kappa* was devoted to military education and training. Both industrialists and educators are requesting more and more information about the techniques being developed and utilized in our program, hoping that they might have use for them. The Defense Department is cooperating more closely than ever before with other Federal and local governmental agencies on projects such as Project TRANSITION. We are hoping that ARISTOTLE continues to foster these good working relationships.

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FLARE

Evaluation of Proposals Completed for Navy's Fast Deployment Logistic Ships

Defense Department and Navy officials have completed evaluation of design and construction proposals for the Navy's Fast Deployment Logistics (FDL) Ships program which were submitted by three companies in January 1967. Litton Systems, Inc., Culver City, Calif., submitted the best technical proposal, considering all relevant factors including efficiency of ship and life cycle cost. Other companies submitting proposals were General Dynamics Corp., Quincy, Mass., and Lockheed Shipbuilding and Construction Co., Seattle, Wash.

The Congress disapproved the authorization in this year's budget request to move ahead with the program and proceed with construction. If on resubmission the program is approved by the Congress next year, the Navy would award a contract after further negotiation with Litton Systems. The contract would be awarded either to Litton Systems or, if negotiations with that company were unsatisfactory, to the successful bidder in an open competition. The bidding opportunity would be industry-wide and would include the three original contractors with the design plans to be based on the Litton Systems proposal.

The selected design contemplates large, fast, non-combatant ships with an endurance of over 8,000 miles, a displacement of about 40,000 tons, and a speed of over 24 knots. Their length (848 feet) and beam (104 feet) will permit them to transit the Panama Canal, and they will be able to use most of the world's major ports. With amphibians and large cargo helicopters, they will be able to offload efficiently and rapidly their 10,000 tons of military cargo, including wheeled and tracked vehicles, without dependence on port or existing handling facilities.

DOD has emphasized its belief that the FDL ships can most efficiently and economically satisfy the continued requirement for specialized military sealift for rapid deployment and rapid reinforcement of Army forces.

DESC and AFSC Study Standardization of Electronic Parts

The Defense Electronics Supply Center (DESC), Dayton, Ohio, and the Air Force Systems Command have developed a joint study project that will permit DESC engineers to serve as standardization advisers during the development of four major Air Force weapon systems.

The project's objective is to establish a more economical and reliable electronic parts inventory. Primarily, it will curb the proliferation of new items by standardizing parts at the development level and weed out duplicates before they enter the supply system.

DESC engineers will be entitled to attend Parts Control Board meetings involving F–111 MARK II and C–5A aircraft, the SRAM missile and the 407L system. Each firm will report on items proposed for its respective assembly. This will enable all sub-contractors to immediately pinpoint areas where standardization might be introduced.

The center engineers will help identify common parts and counsel sub-contractors on format and technical problems related to the preparation of part specifications.

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